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Revision 2
February 2003

U.S. Department of Energy
Idaho Operations Office

Groundwater Monitoring Plan for the Test Reactor Area Operable Unit 2-13

INEEL
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Idaho National Engineering and Environmental Laboratory

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Prepared for the
U.S. Department of Energy
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ABSTRACT

The *Final Record of Decision for Test Reactor Area, Operable Unit 2-13* was signed in December 1997 and provides for groundwater monitoring to assess future contaminant concentrations at the Test Reactor Area at the Idaho National Engineering and Environmental Laboratory. This Groundwater Monitoring Plan describes the objectives, activities, and assessment procedures that will be performed to support the groundwater-monitoring requirements of the Record of Decision.

SUMMARY

The *Final Record of Decision for Test Reactor Area, Operable Unit 2-13* was signed in December 1997 and provides for groundwater monitoring to assess future contaminant concentrations at the Test Reactor Area at the Idaho National Engineering and Environmental Laboratory. This Groundwater Monitoring Plan describes the objectives, activities, and assessment procedures that will be performed to support the groundwater-monitoring requirements of the Record of Decision.

Monitoring activities have been designed to verify the contaminant concentration trends in the Snake River Plain Aquifer predicted by the Operable Unit 2-12 computer model and evaluate the effects that discontinued discharge to the warm waste pond has on the underlying water bodies. In addition, the deep-perched water system will be monitored for potential mercury migration from the Chemical Waste Pond. To meet these objectives, groundwater monitoring will be performed on seven wells completed in the deep-perched water system (PW-11, PW-12, PW-14, USGS-53, USGS-54, USGS-55, and USGS-56) and six wells completed in the Snake River Plain Aquifer (Hwy-3, TRA-06, TRA-07, TRA-08, USGS-58, and USGS-65).

Water samples will be collected semiannually for the contaminants that exceed the Idaho groundwater quality standards, annually for the contaminants that are predicted to exceed the Idaho groundwater quality standards, and once every 5 years for all potential contaminants of concern that have been identified at the Test Reactor Area. For the deep-perched water system, this strategy results in the semiannual sampling for cadmium, chromium, mercury, cobalt-60, strontium-90, and tritium; and annual sampling for mercury. For the Snake River Plain Aquifer, this strategy results in semiannual sampling for chromium and tritium; and annual sampling for cadmium, cobalt-60, and strontium-90. Finally, all potential contaminants of concern will be sampled once every 5 years. These contaminants include arsenic, beryllium, cadmium, chromium, lead, manganese, fluoride, cobalt-60, cesium-137, americium-241, strontium-90, and tritium.

In accordance with the requirements of the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*, quality-assured data collected during groundwater monitoring will be submitted to the Agencies (i.e., U.S. Department of Energy Idaho Operations Office, Idaho Department of Environmental Quality, and U.S. Environmental Protection Agency) no later than 120 days from the time of collection. Data summary submittals and updates of information will be transmitted on the status of trending data in the form of an interim report. In addition, a technical memorandum will be prepared at the end of the 5-year monitoring period that describes the results of the groundwater monitoring. This technical memorandum will discuss changes to the hydrogeologic setting over the past 5 years; the measured contaminant concentrations versus the model-predicted concentrations, data trends, and future predicted concentrations; and provide recommendations for the next 5 years of groundwater monitoring.

CONTENTS

FIGURES

TABLES

ACRONYMS

bls	below land surface
CFR	Code of Federal Regulations
DOE-ID	U.S. Department of Energy Idaho Operations Office
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
ES&H	environment, safety, and health
FTL	field team leader
FSP	Field Sampling Plan
GDE	guide
GMP	Groundwater Monitoring Plan
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HSO	health and safety officer
ID	identification
IDAPA	Idaho Administrative Procedures Act
IH	industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
MCL	maximum contaminant level
MCP	management control procedure
OU	operable unit
PM	project manager
PPE	personal protective equipment
PRD	program requirements document
QAPjP	Quality Assurance Project Plan

QC	quality control
RCT	radiological control technician
RI/BRA	remedial investigation/baseline risk assessment
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SOW	Statement of Work
SRPA	Snake River Plain Aquifer
TPR	technical procedure
TRA	Test Reactor Area
USGS	United States Geological Survey
WAG	waste area group

Groundwater Monitoring Plan for the Test Reactor Area Operable Unit 2-13

1. INTRODUCTION

In December 1997, the *Final Record of Decision for Test Reactor Area, Operable Unit 2-13* was signed (DOE-ID 1997a). The comprehensive Record of Decision (ROD) presents the selected remedial actions and provides for groundwater monitoring to assess future contaminant concentrations at the Test Reactor Area (TRA) at the Idaho National Engineering and Environmental Laboratory (INEEL). This Groundwater Monitoring Plan (GMP) was developed to address the post-ROD monitoring requirements identified in the Operable Unit (OU) 2-13 ROD for the Snake River Plain Aquifer (SRPA) and the deep-perched water system at the TRA. It incorporates previous groundwater-monitoring activities that were being performed under the *Record of Decision for the Test Reactor Area Perched Water System, Operable Unit 2-12* (DOE-ID 1992).

This GMP describes the objectives, activities, and assessment procedures that will be performed to support the groundwater quality-monitoring requirements of the ROD. This plan has been prepared pursuant to the "National Oil and Hazardous Substances Pollution Contingency Plan" (40 CFR 300) and is consistent with U.S. Environmental Protection Agency (EPA) guidance documents. This GMP is comprised of two parts: (1) the Field Sampling Plan (FSP) and (2) the Quality Assurance Project Plan (QAPjP). The FSP describes the field-sampling activities that will be performed, while the QAPjP details the processes and programs that will be used to ensure that the data generated are suitable for their intended uses. The governing QAPjP for this sampling effort is the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2002). This document is incorporated herein by reference.

1.1 Regulatory Background

In December 1992, the ROD was issued for the OU 2-12 TRA perched water system (DOE-ID 1992). It was determined that no remedial action was necessary for the deep-perched water system to ensure protection of human health and the environment. That decision was based on the results of human health and ecological risk assessments, which determined that conditions at the site pose no unacceptable risks to human health or the environment for expected or future use of the SRPA beneath the deep-perched water system at the TRA. One of the assumptions for the no-remedial-action decision was that groundwater monitoring would be performed to verify that contaminant concentration trends follow those predicted by the OU 2-12 computer model. It was further stated in the OU 2-12 ROD that a statutory review of this decision would be conducted by the three agencies within 3 years to ensure that adequate protection of human health and the environment continues to be provided (DOE-ID 1992).

The results from the OU 2-12 groundwater monitoring are described in a series of three annual technical memoranda. Following 3 years of groundwater monitoring, the results from the entire OU 2-12 post-ROD monitoring were described in the *Post-Record of Decision Monitoring for the Test Reactor Area Perched Water System Operable Unit 2-12, Third Annual Technical Memorandum* (Arnett, Meachum, and Jessmore 1996), which presented 3 years of post-ROD monitoring data and includes an evaluation of hydrologic and groundwater contaminant conditions for the TRA deep-perched water system and the underlying SRPA. The results from this Technical Memorandum were then incorporated into the *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997b).

Data summary submittals and updates of information will be transmitted on the status of trending data in the form of an interim report. The interim report will be issued, as deemed necessary, to update the Agencies with project data.

In December 1997, the OU 2-13 ROD was issued (DOE-ID 1997a). According to this ROD, the objectives of the groundwater-monitoring program are to verify contaminant concentration trends in the SRPA, as predicted by computer modeling, and to evaluate the effect that discontinuing discharge to the warm waste pond has had on contaminant concentrations in the SRPA and the deep-perched water system. This GMP describes how the objectives for the OU 2-13 groundwater-monitoring program will be met.

1.2 Groundwater Monitoring Plan

The purpose of this GMP is to guide the collection and analysis of groundwater samples to support the OU 2-13 post-ROD monitoring at the TRA. Development of the GMP was based on the data requirements identified from the OU 2-12 ROD (DOE-ID 1992), the OU 2-13 ROD (DOE-ID 1997a), and the past 3 years of post-ROD monitoring at the TRA. This GMP has been designed to maximize data utility while, at the same time, minimize the analytical load.

This GMP includes:

- Development and justification for the sampling and analysis objectives
- Discussion of types of sampling to be conducted, including groundwater monitoring, groundwater-level measurements, and the types of analyses to be performed
- Determination of sample locations and frequency on the basis of available data (i.e., well construction/completion, historical water level data, historical water quality data, and other relevant considerations)
- Description of all sampling equipment and sample collection procedures to be used
- Specification of a consistent, logical process for sample designation throughout the duration of routine monitoring
- Health and safety requirements
- Quality assurance requirements
- General schedule for sampling and the reporting of monitoring results.

2. SITE DESCRIPTION AND BACKGROUND

The INEEL is a government-owned reservation managed by the U.S. Department of Energy. The eastern boundary of the INEEL is located 52 km (32 mi) west of Idaho Falls, Idaho. The INEEL site occupies approximately 2,305 km^2 (890 mi^2) of the northwestern portion of the Eastern Snake River Plain in southeast Idaho. The TRA is located in the west-central portion of the INEEL, as shown in Figure 2-1.

The TRA was established in the early 1950s for studying the effects of radiation on materials, fuels, and equipment. Three major reactors have been built at the TRA—(1) the Materials Test Reactor, (2) the Engineering Test Reactor, and (3) the Advanced Test Reactor. Currently, the Advanced Test Reactor is the only operating reactor at the TRA.

2.1 Site Description

Surficial material at TRA consists of alluvial and terrace deposits of the Big Lost River and is composed of unconsolidated fluvial deposits of silt, sand, and pebble-size gravel. The uneven alluvial thickness and undulating basalt surface at TRA are common features of basalt flow morphology. A complex sequence of basalt flows and sedimentary interbeds exists beneath the alluvial deposits. Petrographically similar basalt flows were correlated from basalt flow samples collected into 23 flow groups that erupted from related source areas (Anderson 1991). Sedimentary interbeds that vary in thickness and lateral extent separate these basalt flows.

The SRPA occurs approximately 137 m (450 ft) below TRA and consists of a series of saturated basalt flows and interlayered pyroclastic and sedimentary materials. The aquifer is relatively permeable because of the presence of fractures, fissures, and voids (such as lava tubes) in the basalt. Groundwater flow in the SRPA is to the south-southwest at rates between 1.5 and 6 m/day (5 and 20 ft/day). The water table elevation in the SRPA for March through May 1995 is provided in Figure 2-2.

Two perched water zones have been identified below TRA (Figure 2-3). A shallow perched-water zone is formed at a depth of approximately 15.2 m (50 ft) near the TRA disposal ponds and retention basin. Finer-grained sediments and fracture infilling at the alluvium and basalt interface impede the downward movement of water, resulting in perched conditions. The shallow, perched water eventually percolates through the underlying basalt to a deeper perched-water zone. The deep-perched water zone also is caused by low-permeability sediments within the interbedded basalt-sediment sequence; the deep-perched water zone occurs at approximately 43 to 61 m (140 to 200 ft). These sediments include silt, clay, cinders, and gravel and appear to be laterally continuous near TRA. The shallow and deep-perched waters are two separate zones, with the possible exception of the area of the TRA ponds where they might become one zone, depending on the volume of wastewater discharge to the ponds.

The perched water bodies are present because approximately 757 million L/yr (200 million gal/yr) of water has been sent to the TRA disposal ponds over the past several decades. A major contributor to the contamination in the perched water bodies resulted from historical discharges to the former warm waste pond. In August 1993, low-level radioactive waste discharges were discontinued to the former warm waste pond and diverted to a new, lined evaporation pond. This new pond is equipped with an impermeable liner to prevent infiltration of contaminated wastewater to the subsurface.

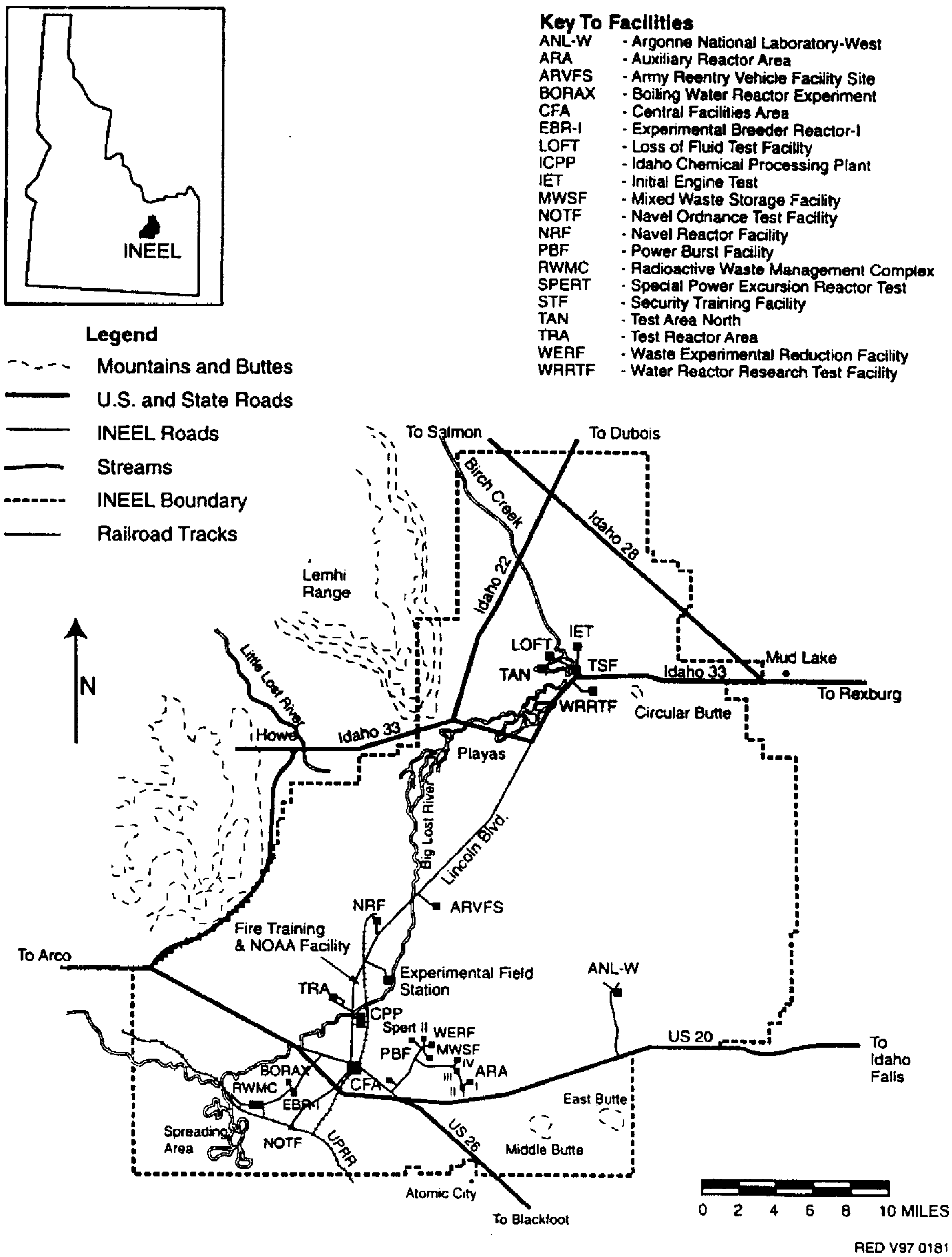

Figure 2-1. Location of the Test Reactor Area at the Idaho National Engineering and Environmental Laboratory.

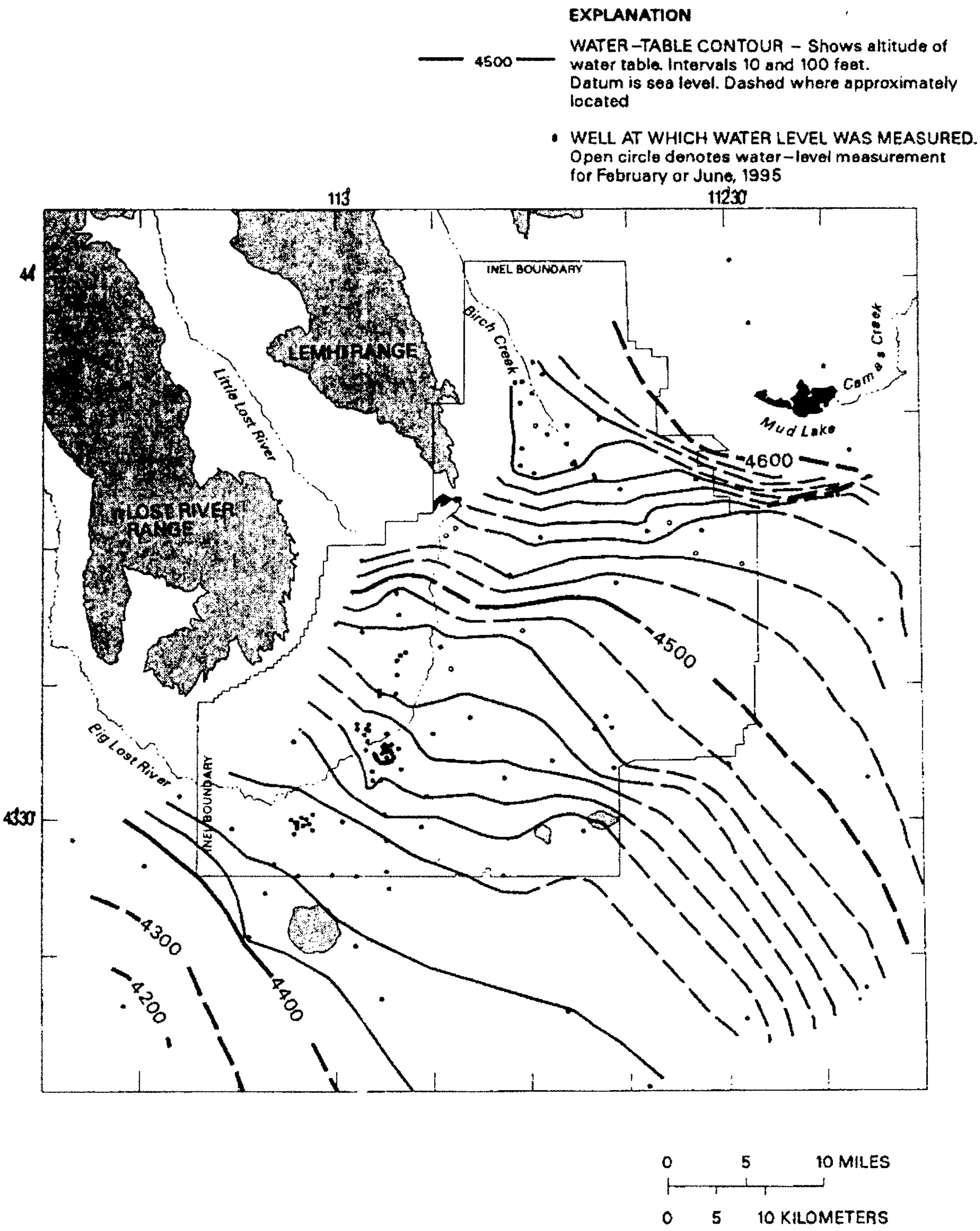

Figure 2-2. Water table elevation in the Snake River Plain Aquifer for March through May 1995.

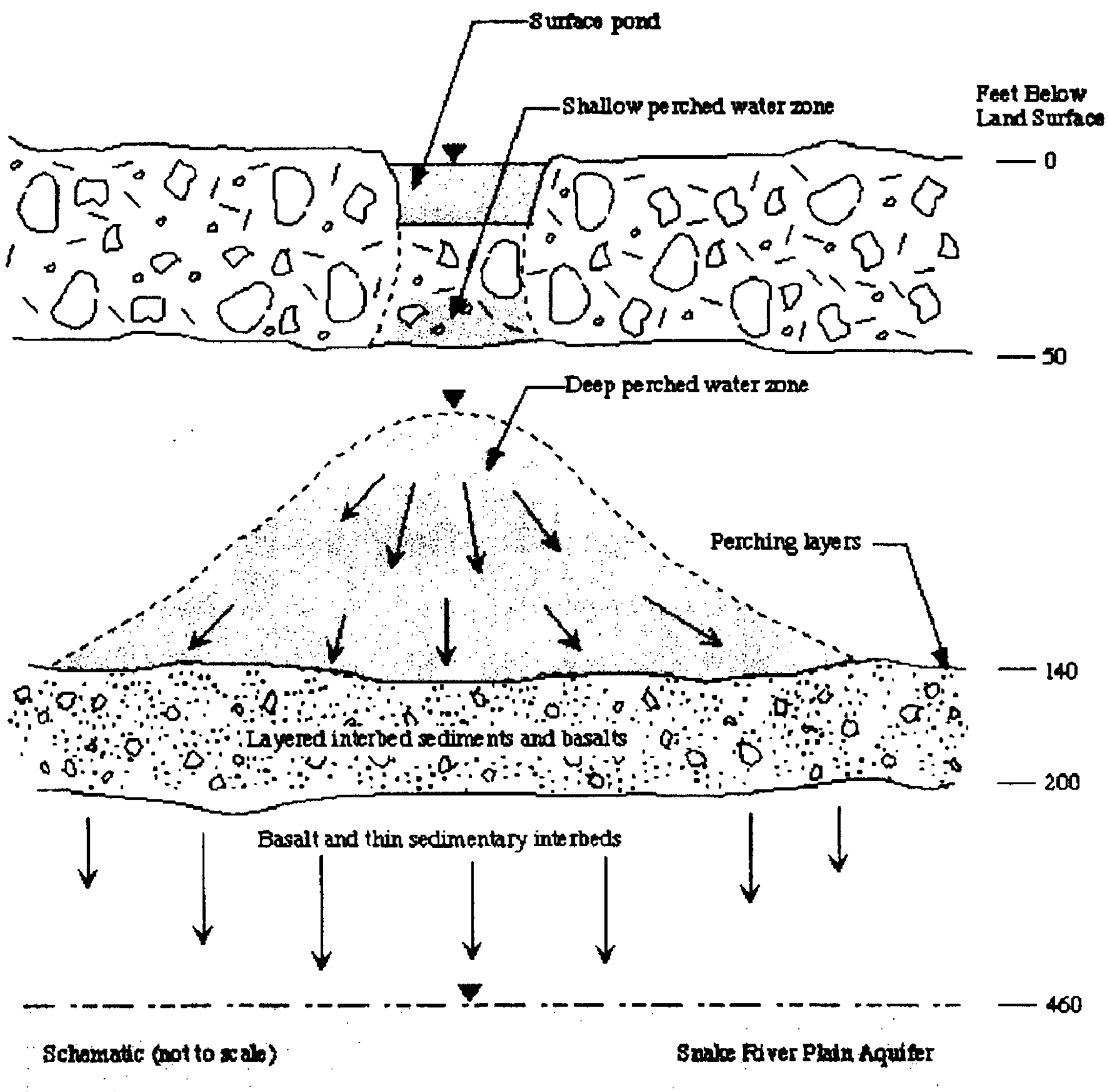

Figure 2-3. Schematic of the perched water zones beneath the Test Reactor Area.

Other disposal ponds at the TRA include the cold waste pond and the chemical waste pond. Currently, the cold waste pond receives an average of approximately 1,135 L/min (300 gal/min) of uncontaminated wastewater. There appears to be strong correlation between hydraulic head patterns in the perched water system and the discharge rate to the cold waste pond (Arnett, Meachum, and Jessmore 1996). In addition, discharges to the chemical waste pond, which is an unlined surface impoundment designed as an infiltration pond to receive chemical waste from the demineralization plant, average approximately 57 L/min (15 gal/min). Discharges to the chemical waste pond were discontinued in 1998.

2.2 Source, Nature, and Extent of Contamination

Infiltration of wastewater from the pond system at TRA has caused the migration of contaminants to the deep-perched water system and ultimately to the SRPA. In addition, the TRA disposal well disposed of wastewater from the cold waste sampling pit (TRA-764) into the SRPA until 1982, when the well was taken out of service and turned into a monitoring well. This disposal well was the primary source of chromium contamination in the aquifer, since the water in the cooling towers was treated with chromate to inhibit corrosion. The total amount of chromium discharged to the disposal well from January 1, 1964, through December 31, 1972, is approximately 14,121 kg (31,131 lb). According to the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final),* the amount of chromium and tritium discharged to the warm waste pond is estimated at 8,070 kg (17,791 lb) and 8,920 Ci, respectively (DOE-ID 1997c).

2.2.1 Test Reactor Area Disposal Well

The TRA disposal well, located in the southwest corner of the TRA (Figure 2-4), was drilled in 1962 and 1963, and it was put into service in November 1964. During its operational period from 1964 to 1982, it was used for the disposal of cold liquid waste from the TRA. This waste stream primarily consists of cooling tower blow down, but also includes water from air-conditioning units, secondary system drains, and other nonradioactive drains. From 1964 to 1982, approximately 15 billion L (3.9 billion gal) of wastewater containing an estimated 14,121 kg (31,131 lb) of hexavalent chromium was disposed of in the well. This constitutes approximately 56% of the total amount of chromium discharged at the TRA.

The TRA disposal well was drilled and cased to a depth of 387 m (1,271 ft), with 0.6 × 15-cm (0.25 × 6-in.) slot perforations in the casing from 360 to 389 m (1,182 to 1,276 ft) below land surface (bls). In early May 1965, injection testing revealed that this perforated interval resulted in insufficient capacity under gravity flow conditions (Morris et al. 1965). After accepting between 2,044 and 3,138 L/min (540 and 829 gpm) for 44 hours, the water level rose into the surface pit at a depth of 6 m (20 ft) bls. Between July 29 and August 3, 1964, additional perforations were added to the casing between 283 and 326 m (930 and 1,070 ft). During this perforation event, the casing was severed at 306 m (1,005 ft) bls. Then, a 42-hour injection test was run from August 3–5, 1964, to evaluate the effects of the additional perforations. After 42 hours at an average disposal rate of 2,650 L/min (700 gpm), the water level rose into the surface pit located at a depth of 6 m (20 ft) bls. A third set of perforations was made in the interval between 156 and 212 m (512 and 697 ft). Addition of the upper perforations allowed flow rates to the well of over 3,785 L/min (1,000 gpm) without measurable head buildup and made the well suitable for daily operations. Disposal of wastewater began in November 1964.

A number of geophysical and flow meter surveys have been performed on the TRA disposal well. During the first remedial perforation event, the casing in the well was severed and shifted in the borehole. Since then, it has not been possible to get any borehole geophysical tools past a depth of 308 m (1,010 ft) (Morris et al. 1965). In the early 1960s, flow meter surveys were conducted at the TRA disposal well to determine the effect of the perforations on the discharge of injected fluid on the formation. These surveys injected a small quantity of radioactive tracer at a point in the well bore and then measured the rate at which the tracer moved up or down the well bore. During one of the flow meter surveys, 1,987 L/min (525 gpm) of the 2,082 L/min (550 gpm) injected into the well discharged over the 156- to 180-m (512- to 590-ft) bls interval. Based on these surveys, the majority (approximately 95%) of the wastewater injected into the TRA disposal well entered the SRPA over this upper interval, with relatively little wastewater entering the deeper perforated intervals.

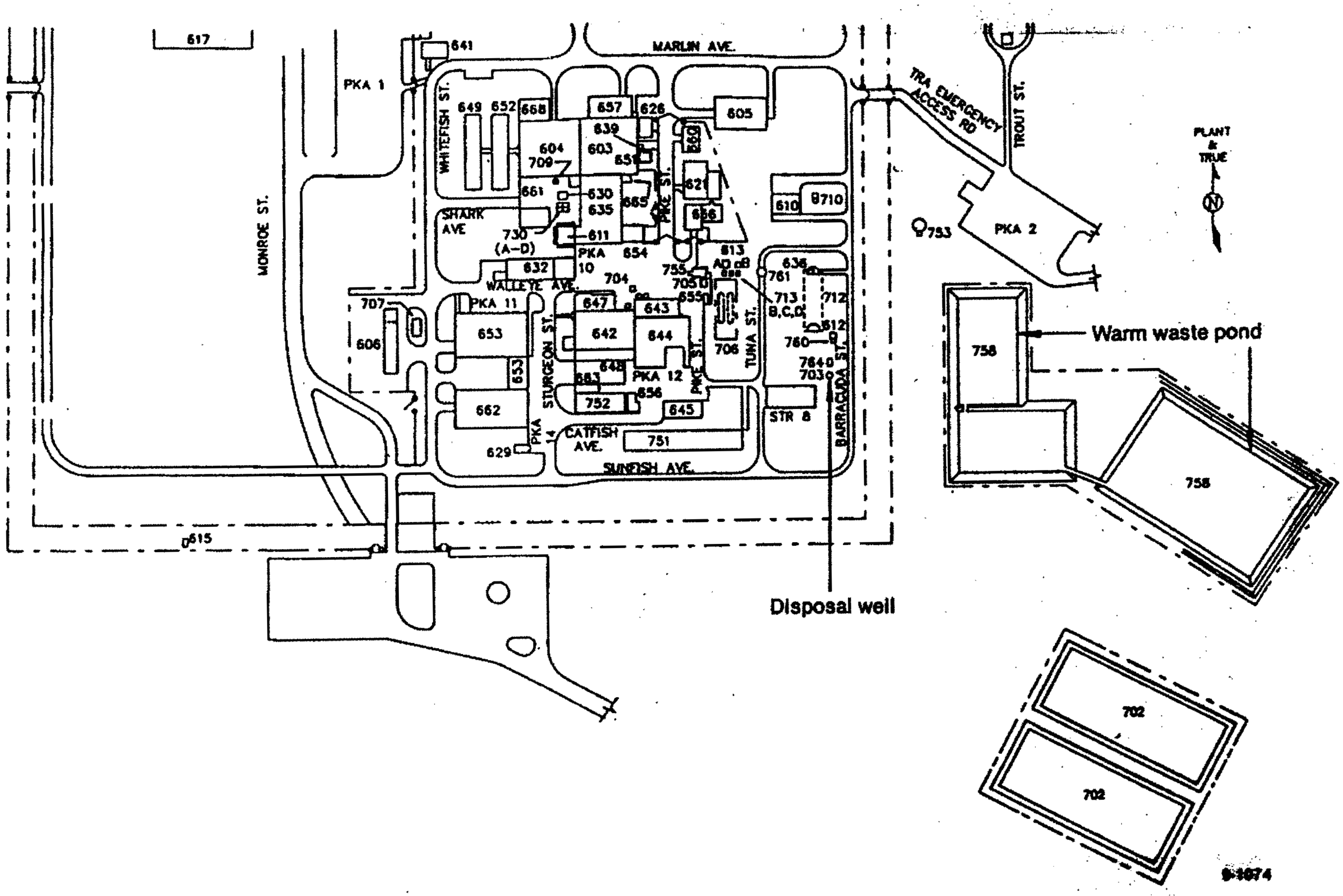

Figure 2-4. Location of the Test Reactor Area disposal well.

2.2.2 Groundwater Monitoring

Groundwater monitoring at the TRA has been performed as part of OU 2-12 post-ROD activities and also by the United States Geological Survey (USGS). The USGS is an independent agency, funded partially by the U.S. Department of Energy, that maintains groundwater-monitoring networks at the INEEL to characterize the occurrence, movement, and quality of water and to delineate waste-constituent plumes in the SRPA and the perched groundwater systems overlying the aquifer (Cecil et al. 1991).

The monitoring well network for the deep-perched water system at the TRA is shown in Figure 2-5. The USGS perched groundwater monitoring at the TRA complements the OU 2-12 post-ROD monitoring. The OU 2-12 network includes six wells that were sampled quarterly and analyzed for five radiological and eight nonradiological constituents from 1993 through 1996. Beginning in January 1997, these six wells were sampled semiannually for three radiological and two nonradiological constituents. The USGS perched groundwater-monitoring well network includes 18 wells with the water samples being analyzed for fewer constituents. Thus, the USGS network provides a better evaluation of contaminant concentrations throughout the TRA for a few constituents, whereas the OU 2-12 network provides a more detailed view of key contaminant changes at fewer wells. Combined, these two monitoring programs provide good coverage of the deep-perched water system.

In the SRPA, five wells located downgradient from the TRA currently are used to monitor contaminant concentrations in the SRPA. These wells are identified as TRA-06, TRA-07, TRA-08, USGS-58, and USGS-65. The monitoring well network in the SRPA is identified in Figure 2-6.

2.2.1.1 Deep Perched Groundwater. The TRA deep-perched water system is the result of water infiltrating from several different surface sources, including the cold waste pond, chemical waste pond, and sewage ponds. On August 12, 1993, discharge to the former warm waste pond was discontinued, and the low-level radioactive wastewater stream previously discharged to those ponds was diverted to a newly constructed and lined evaporation pond. During the period from 1993 through 1996, the calculated volume of the deep-perched water system decreased by approximately 19%, which was largely attributed to the decreased discharge to the cold waste pond since 1993. The configuration of the water table for the deep-perched water system in April 1996 is shown in Figure 2-7 (Arnett, Meachum, and Jessmore 1996).

Since April 1996, the OU 2-12 post-ROD monitoring has been collecting semiannual water-level measurements from six wells completed in the deep-perched water system (Figure 2-8). Well USGS-53 has been dry throughout this monitoring period, and USGS-56 was dry beginning in January 1998. From January 1997 through January 1998, it appears that the water level might have increased in Wells PW-11 and PW-12 and slightly decreased in Wells USGS-54 and USGS-55. The water levels in the deep-perched water system directly correlate with the discharge rate to the surface disposal ponds and, in particular, the cold waste pond (Arnett, Meachum, and Jessmore 1996).

According to the *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12* (Dames and Moore 1993), the key contaminants in the groundwater include five radioactive contaminants (Am-241, Cs-137, Co-60, Sr-90, and tritium) and eight chemical contaminants (arsenic, beryllium, cadmium, chromium, cobalt, fluoride, lead, and manganese). During the monitoring period from 1993 through 1996, the following observations were made concerning these contaminants:

- Cs-137 and cobalt were not detected in any well

- Am-241 was detected in five of the six monitoring wells with maximum concentrations ranging from 0.4 (USGS-54 and USGS-56) to 0.97 pCi/L (USGS-55)

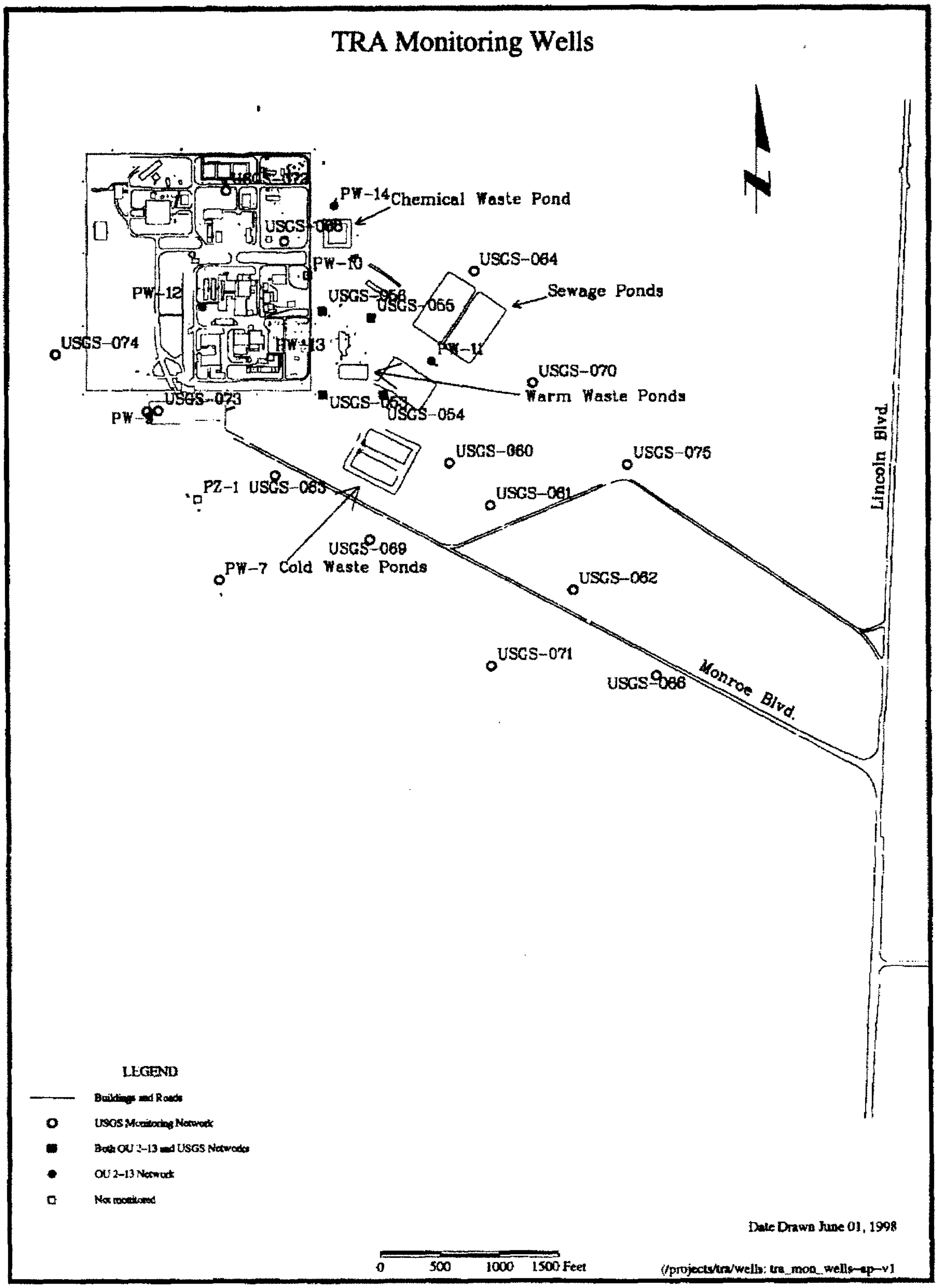

Figure 2-5. Monitoring well network for the deep-perched water system at the Test Reactor Area.

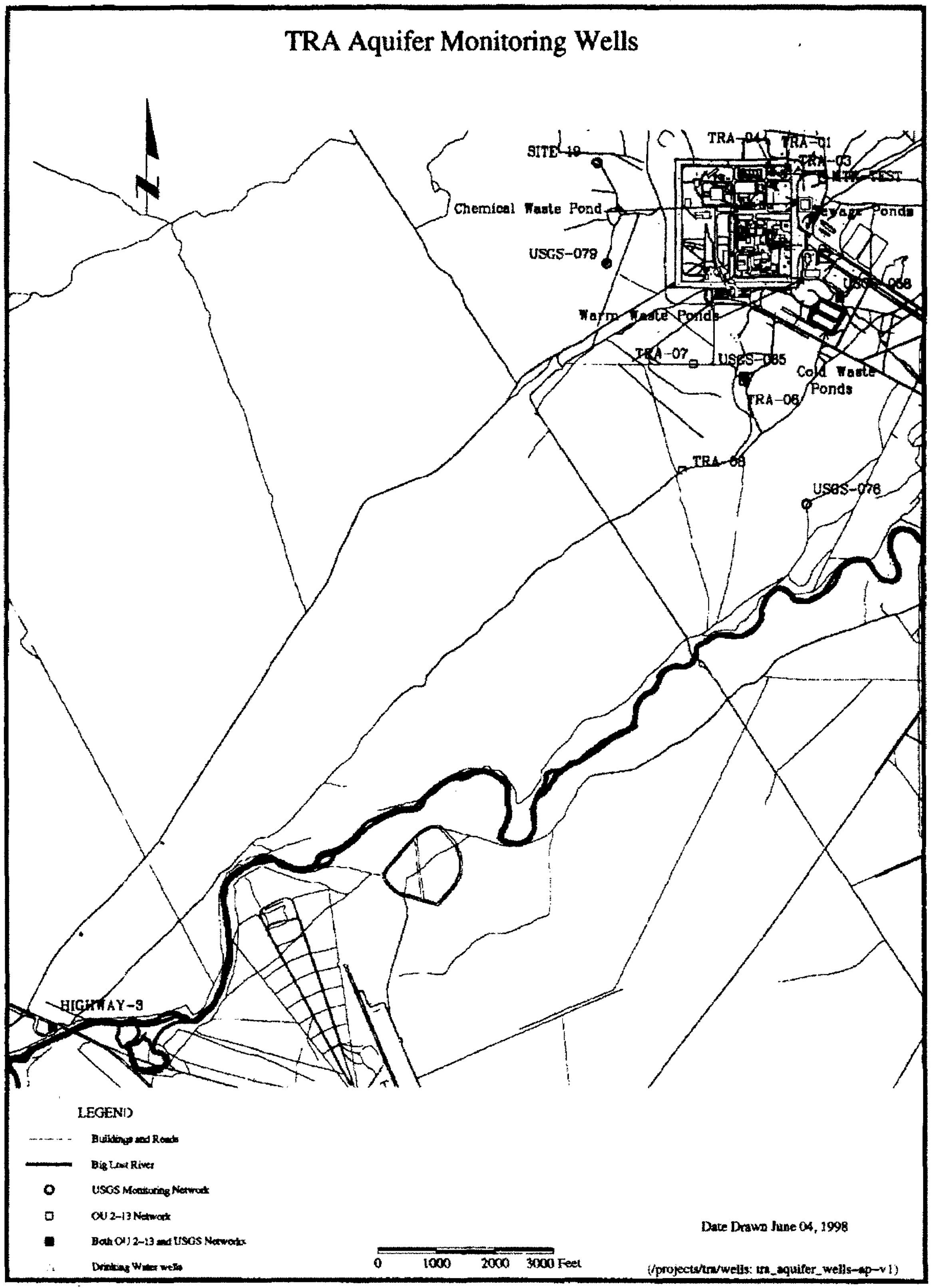

Figure 2-6. Monitoring well network for the Snake River Plain Aquifer at the Test Reactor Area.

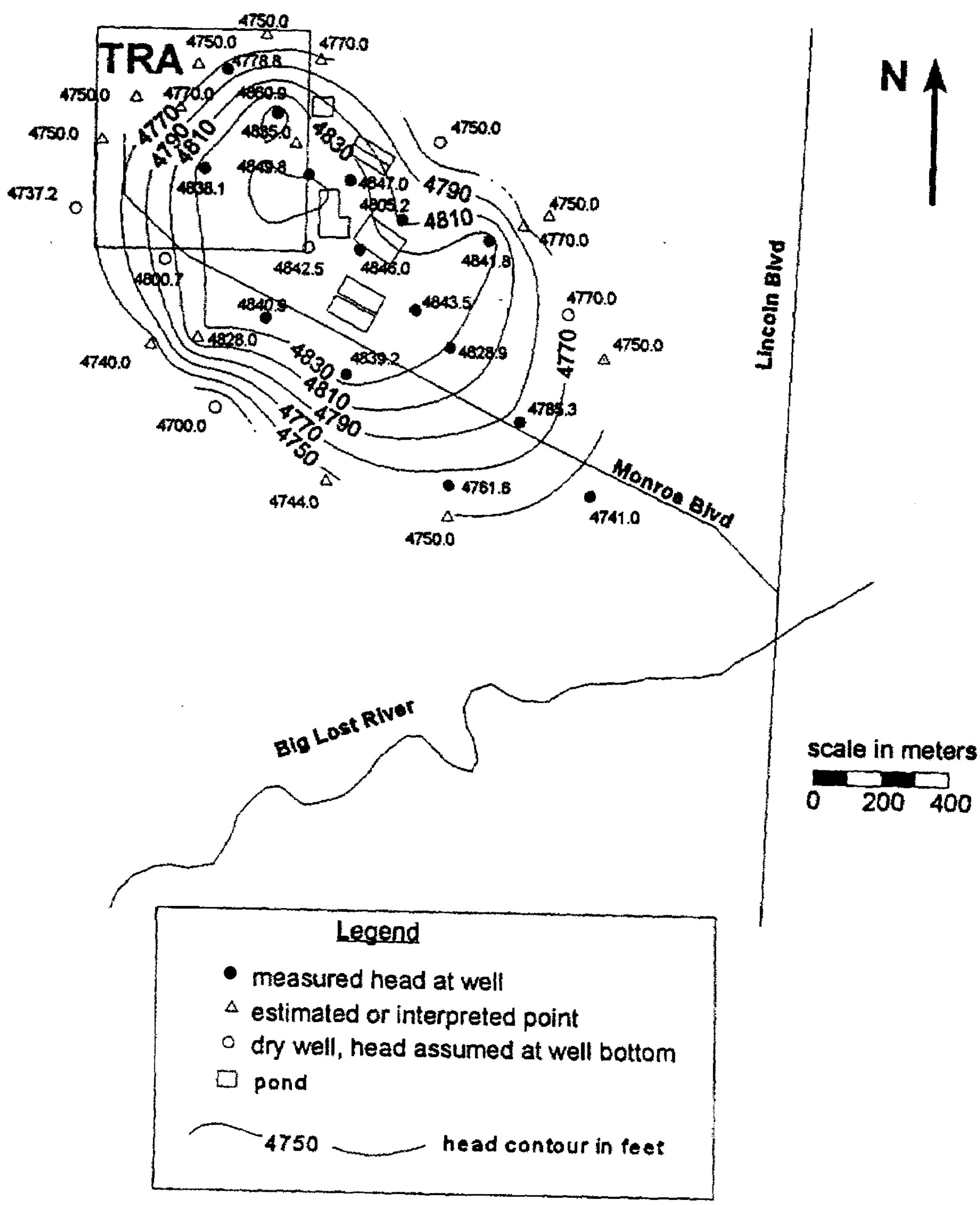

Figure 2-7. Configuration of the water table for the deep-perched water system in April 1996.

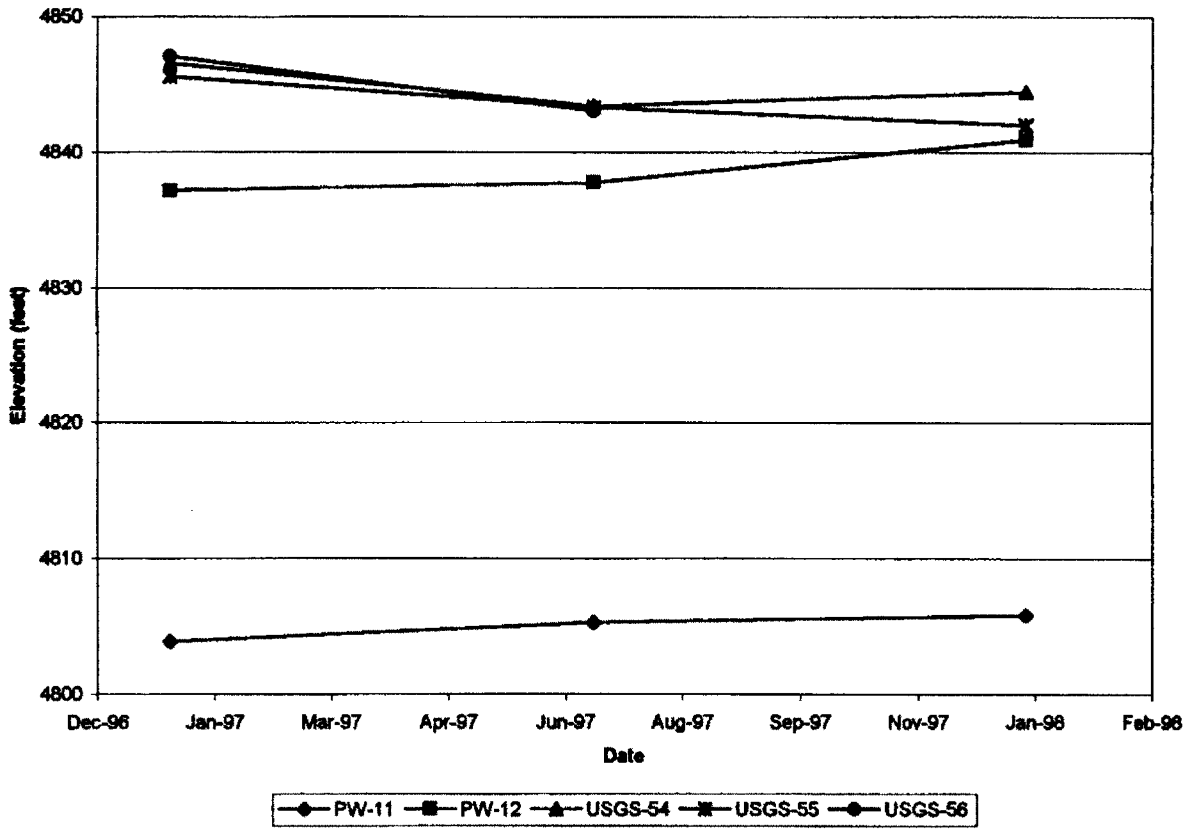

Figure 2-8. Water level elevations in the deep-perched water system from the Operable Unit 2-12 monitoring.

- Co-60 was detected in four of the six monitoring wells with maximum concentrations ranging from 25 (PW-11) to 1,010 pCi/L (USGS-56)

- Sr-90 was detected in all monitoring wells with maximum concentrations ranging from 1.8 (PW-11) to 179 pCi/L (USGS-56)

- Tritium was detected in all monitoring wells with maximum concentrations ranging from 9,920 (USGS-54) to 746,000 pCi/L (USGS-56)

- Arsenic was detected in three of the six monitoring wells with maximum concentrations ranging from 11.7 (USGS-55) to 14.6 μg/L (USGS-54)

- Beryllium was detected in two of the six monitoring wells with maximum concentrations ranging from 5 (USGS-55) to 5.9 μg/L (USGS-56)

- Cadmium was detected in all monitoring wells with maximum concentrations ranging from 2 (USGS-56) to 11.9 μg/L (PW-11)

- Chromium was detected in all monitoring wells with maximum concentrations ranging from 9 (PW-12) to 814 μg/L (USGS-53)

- Fluoride was detected in all monitoring wells with concentrations ranging from 180 to 240 μg/L

- Lead was detected in two of the six monitoring wells with maximum concentrations ranging from 4.6 (PW-12) to 4.8 μg/L (USGS-56)

- Manganese was detected in three of the six monitoring wells with maximum concentrations ranging from 4.9 (PW-12) to 36.1 μg/L (USGS-53).

The key contaminants in terms of significant measured and model-predicted concentrations in the deep-perched water system are tritium and total chromium (Arnett, Meachum, and Jessmore 1996). Bubble graphs of the tritium and chromium concentrations during spring 1995 are shown in Figures 2-9 and 2-10, respectively. This timeframe was selected because it represents the last time water samples were collected successfully from USGS-53. Since this sampling event, water levels in USGS-53 have declined below the bottom of the well. During the spring of 1995, tritium concentrations ranged from nondetect in Wells USGS-54 and USGS-55 to a maximum of 320,000 pCi/L in Well USGS-56. The tritium concentrations have decreased slightly or remained fairly constant in all wells throughout the 1993–1996 monitoring period (Arnett, Meachum, and Jessmore 1996). Chromium concentrations in the deep-perched water system for spring/summer 1995 ranged from nondetect in Wells PW-12 and PW-13 to a maximum of 599 μg/L in Well USGS-53. During the OU 2-12 monitoring period, chromium concentrations decreased slightly or were essentially unchanged in all wells except USGS-53, where a significant increase was observed (Arnett, Meachum, and Jessmore 1996).

Following the OU 2-12 monitoring, the approach to groundwater monitoring at the TRA was modified to incorporate the results from the previous 3 years of monitoring, as identified in the Third Annual Technical Memorandum (Arnett, Meachum, and Jessmore 1996). Since January 1997, TRA groundwater monitoring involved semiannual sampling for chromium, cadmium, tritium, Co-60, and Sr-90 from the wells identified in the OU 2-12 Groundwater Monitoring Plan (Dames and Moore 1993). These changes to the TRA groundwater monitoring were approved by the Agencies in November 1996 in accordance with written correspondence.

The groundwater-monitoring results from January 1997 to present are provided in Table 2-1. Water samples were not collected from USGS-53 or from the past two sampling events from USGS-56 due to a decline in the perched groundwater associated with decreased surface water discharge from TRA. Before going dry, however, both of these wells exceeded the Idaho groundwater quality standard for chromium, Sr-90, and tritium. During the monitoring period from January 1997 through January 1998, the following observations were made for the remaining four wells completed in the deep-perched water system:

- A single sample from USGS-55 exceeded the Idaho groundwater quality standard for chromium (>100 μg/L)

- Water samples from PW-11, USGS-54, and USGS-55 exceeded the Idaho groundwater quality standard for strontium-90 (>8 pCi/L)

- Water samples from PW-11 and USGS-55 exceeded the Idaho groundwater quality standard for tritium (>20,000 pCi/L)

- Cadmium was not detected in any samples.

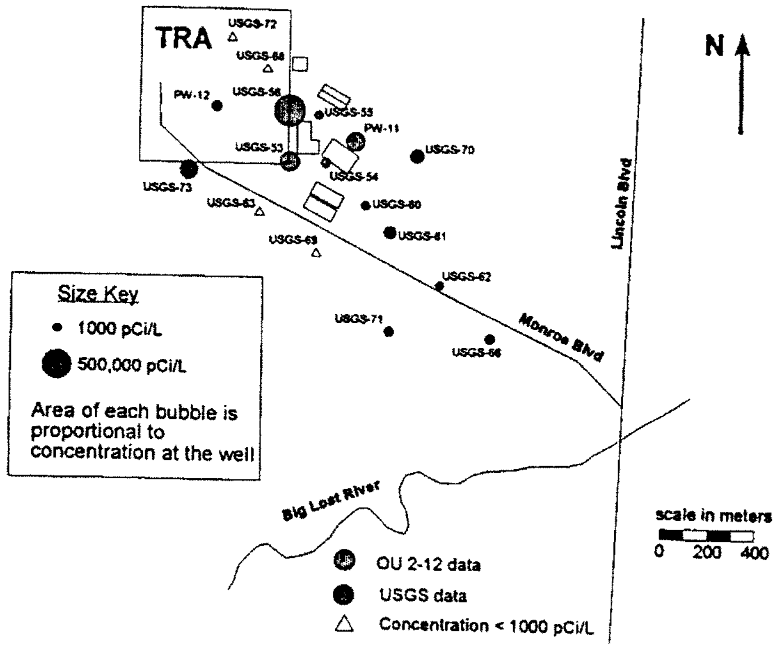

Figure 2-9. Tritium concentrations in the deep-perched water system during spring 1995.

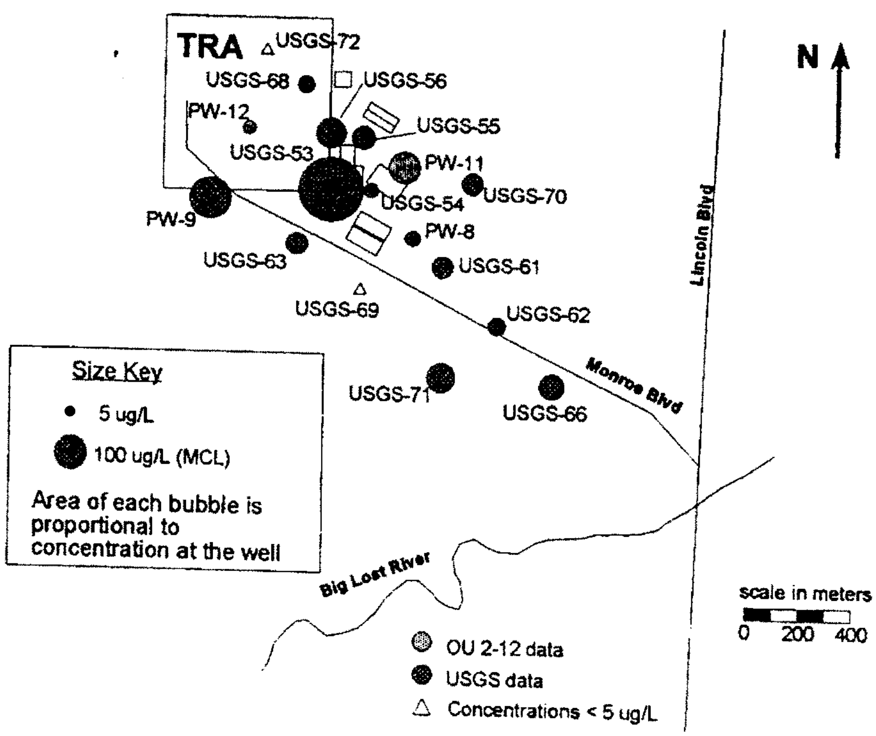

Figure 2-10. Chromium concentrations in the deep-perched water system for spring/summer 1995.

Table 2-1. Operable Unit 2-12 monitoring results (1997 to present).

Perched Water Wells							
Analyte	PW-11	PW-12	USGS-53	USGS-54	USGS-55	USGS-56	Water Quality Standard[a]
Cadmium (μg/L)							
1/97	5.0U	5.0U	Dry	5.0U	5.0U	5.0U	5
7/97	5.0U	5.0U	Dry	5.0U	5.0U	Dry	
1/98	5.0U	5.0U	Dry	5.0U	5.0U	Dry	
Chromium (μg/L)							
1/97	69.5B	10.0U	Dry	10.0B	71.3B	**110**	100
7/97	67.7B	10.0U	Dry	10.5B	101	Dry	
1/98	62.1	17.4B	Dry	15.5B	77.3B	Dry	
Co-60 (pCi/L)							
1/97	15.50	39.0U	Dry	-5.75U	3.10U	200	NA
7/97	12.5U	14.0U	Dry	2.21U	2.32U	Dry	
1/98	7.89U	8.99U	Dry	0.49U	26.9	Dry	
Sr-90 (pCi/L)							
1/97	0.47	**69.3**	Dry	**105**	**10.9J**	**18.2**	8
7/97	0.72J	**56.3J**	Dry	**82.0J**	7.75J	Dry	
1/98	0.57J	**50.1J**	Dry	**70.8J**	11.8J	Dry	
Tritium (pCi/L)							
1/97	**100,000**	4,110	Dry	1,560	10,500	**211,000**	20,000
7/97	**95,600**	2,260	Dry	3,810	**25,200**	Dry	
1/98	**73,500**	1,540	Dry	4,180	**98,400**	Dry	

Snake River Plain Aquifer Wells						
Analyte	TRA-06	TRA-07	TRA-08	USGS-58	USGS-65	Standard[a]
Cadmium (μg/L)						
1/97	5.0U	5.0U	5.0U	5.0U	5.0U	5
7/97	5.0U	5.0U	5.0U	5.0U	5.0U	
1/98	5.0U	5.0U	5.0U	5.0U	5.0U	
Chromium (μg/L)						
1/97	12.3B	**185**	92.4B	16.4B	**185**	100
7/97	10.0U	**157**	46.6B	14.2B	**166**	
1/98	10.4B	**170**	**107**	15.5B	**171**	
Co-60 (pCi/L)						
1/97	ND	ND	ND	ND	ND	NA
7/97	ND	ND	ND	ND	ND	
1/98	ND	ND	ND	ND	ND	
Sr-90 (pCi/L)						
1/97	0.18	-0.03UJ	0.13U	0.13U	0.04U	8
7/97	-0.05UJ	0.04UJ	0.12UJ	0.01UJ	-0.12UJ	
1/98	0.01UJ	0.07UJ	4.92J	-0.01UJ	0.29UJ	

Table 2-1. (continued).

	Snake River Plain Aquifer Wells					
Analyte	TRA-06	TRA-07	TRA-08	USGS-58	USGS-65	Water Quality Standard[a]
Tritium (pCi/L)						
1/97	4,930	**28,000**	13,300	4,000	17,100	20,000
7/97	4,620	**26,300**	12,700	3,670	18,700	
1/98	4,190	**23,500**	19,500	3,290	17,100	

a. Water quality standard is based on IDAPA 16.01.11.200 (Idaho Groundwater Quality Rule).
Bold indicates concentrations exceeding Idaho Groundwater Quality Standards.
U = Not detected. Concentration is less than the value identified.
J = Estimated concentration.
B = Contaminant identified in the associated blank.
ND = Not detected.
TRA = Test Reactor Area
USGS = United States Geological Survey

2.2.2 Snake River Plain Aquifer

Groundwater beneath the TRA has been monitored as part of the OU 2-12 post-ROD activities from 1993 through 1996. According to the Groundwater Monitoring Plan (Dames and Moore 1993), the key contaminants from the TRA include five radioactive contaminants (Am-241, Cs-137, Co-60, Sr-90, and tritium) and eight chemical contaminants (arsenic, beryllium, cadmium, chromium, cobalt, fluoride, lead, and manganese). From the OU 2-12 computer modeling, the expected near-term changes in contaminant concentrations for the SRPA are:

- Am-241, arsenic, beryllium, Cs-137, fluoride, lead, and manganese concentrations are expected to remain below detection
- Cadmium and Sr-90 concentrations might increase and then be followed by a decrease
- Chromium and tritium concentrations are expected to continue to decrease.

Arsenic, beryllium, Cs-137, and Co-60 remained below the detection limits during the OU 2-12 monitoring, as predicted by the groundwater model. The maximum observed concentration of Am-241 was slightly above the detection limit in a single sample, but less than 1/20 the proposed maximum contaminant level (MCL). The Sr-90 concentrations also were below the detection level, contrary to model expectations. Fluoride and lead concentrations were below the background for the SRPA. No background for manganese is given, but the maximum detected concentration is far below the Idaho groundwater quality standard. Cadmium has been detected at concentrations slightly above the detection limit and aquifer background.

From the OU 2-12 and USGS monitoring near TRA, only tritium and chromium concentrations in the SRPA exceeded the Idaho groundwater quality standards.

2.2.2.1 Tritium. The October 1995 distribution of tritium in the groundwater at the INEEL from the USGS monitoring is provided in Figure 2-11. This figure identifies one well, USGS-65, near the TRA that exceeds the Idaho groundwater quality standard of 20,000 pCi/L. Based on the OU 2-12 monitoring, the distribution of tritium near the TRA for spring 1995 is provided in Figure 2-12. This figure indicates that Wells USGS-65 and TRA-07 exceed the MCL. Note that the USGS monitoring does not include TRA-07 in its monitoring network.

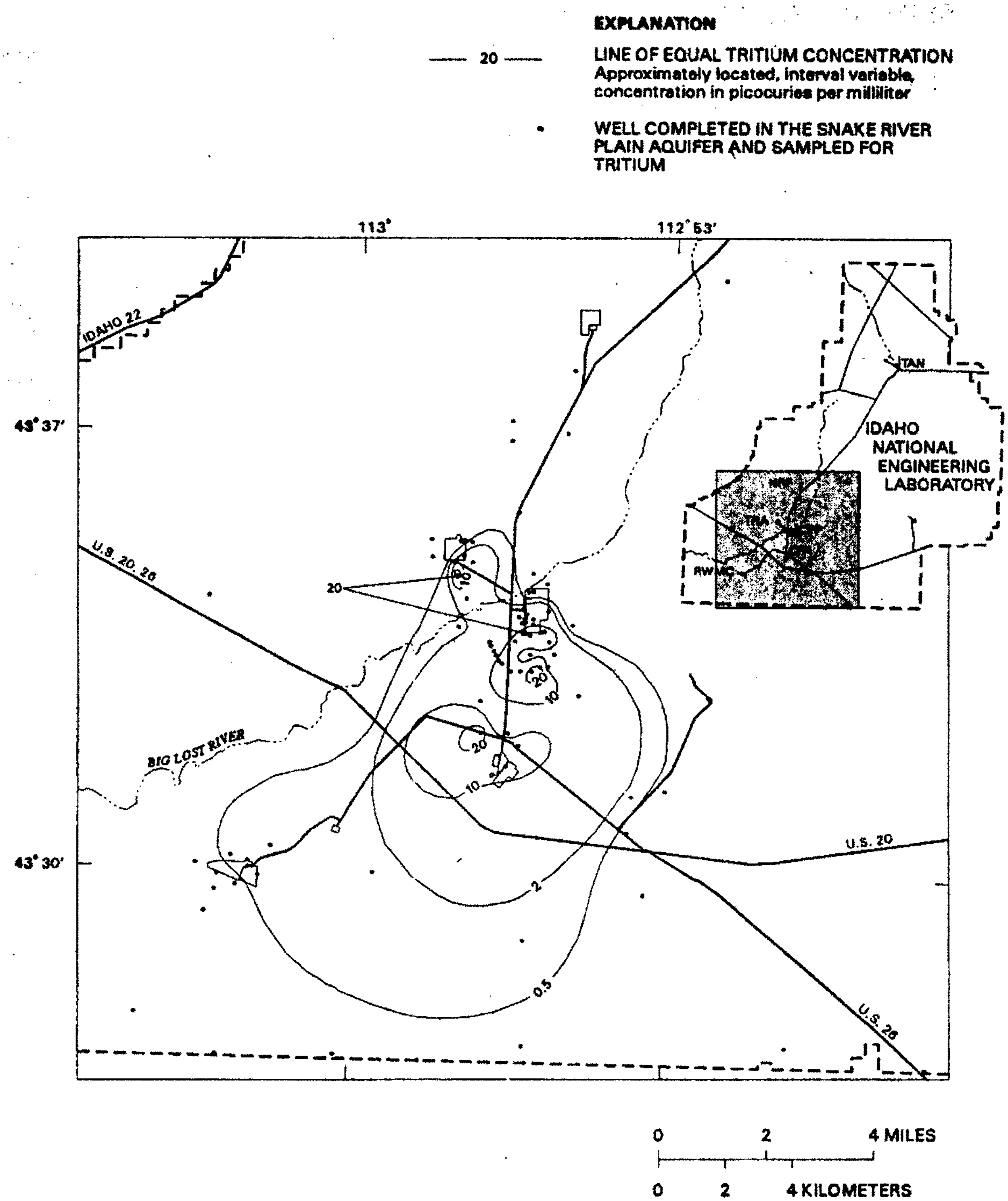

Figure 2-11. Distribution of the tritium in the Snake River Plain Aquifer, October 1995.

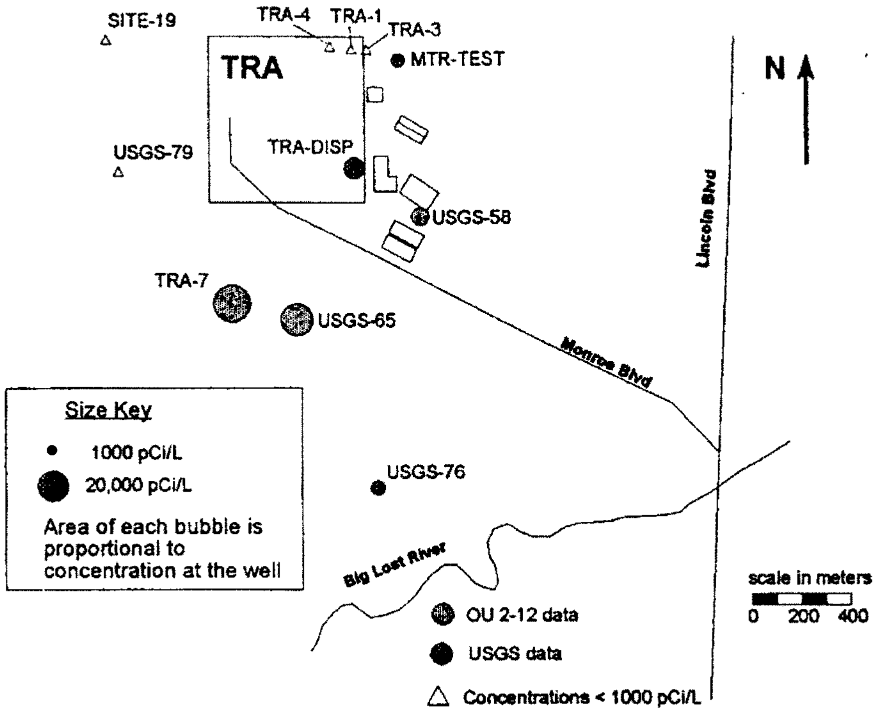

Figure 2-12. Tritium concentrations in the Snake River Plain Aquifer for spring 1995 (Arnett, Meachum, and Jessmore 1996).

From 1993 through 1996, tritium concentrations in the wells located near the TRA ranged from 30,300 to 37,600 pCi/L in Well TRA-07, from 4,200 to 5,590 pCi/L in Well USGS-58, and from 23,000 to 28,600 pCi/L in Well USGS-65. For the wells located near TRA, it appears that the tritium concentrations are decreasing, except in Well USGS-58. Tritium concentrations in this well appear to be increasing, although the highest concentration is quite small when compared to the Idaho groundwater quality standard of 20,000 pCi/L. As of 1996, the tritium concentrations in Wells TRA-07 and USGS-65 have remained above the federal MCL.

Since January 1997, the OU 2-12 monitoring network was expanded to include additional wells, TRA-06 and TRA-08. The results from this monitoring are provided in Table 2-1. During the past three rounds of monitoring, tritium concentrations ranged from 4,190 to 4,930 pCi/L in Well TRA-06, from 23,500 to 28,000 pCi/L in Well TRA-07, from 12,700 to 19,500 pCi/L in Well TRA-08, from 3,290 to 4,000 pCi/L in Well USGS-58, and from 17,100 to 18,700 pCi/L in Well USGS-65. Only the tritium concentrations in Well TRA-07 exceeded the Idaho groundwater quality standard of 20,000 pCi/L during the monitoring period from January 1997 through January 1998.

2.2.2.2 Chromium. The chromium contaminant plume from TRA also is known to extend south of the facility. During the OU 2-12 monitoring, three wells completed in the SRPA (TRA-07, USGS-58, and USGS-65) were sampled quarterly for chromium. The maximum chromium concentration detected during this monitoring was 321 μg/L from Well TRA-07. All chromium concentrations in Wells TRA-07 and USGS-65, and several of the chromium concentrations in Well USGS-58, exceeded the INEEL background chromium concentration in the SRPA of 2 to 3 μg/L (Orr, Cecil, and Knobel 1991). From 1993 through 1996, chromium concentrations in the aquifer showed a pattern of little change or decreasing concentration during the post-ROD monitoring period. Concentrations in Wells TRA-07 and USGS-65 show a similar pattern, having concentrations of 170 μg/L and 151 μg/L, respectively. The distribution of chromium in the SRPA for spring 1995 is provided in Figure 2-13.

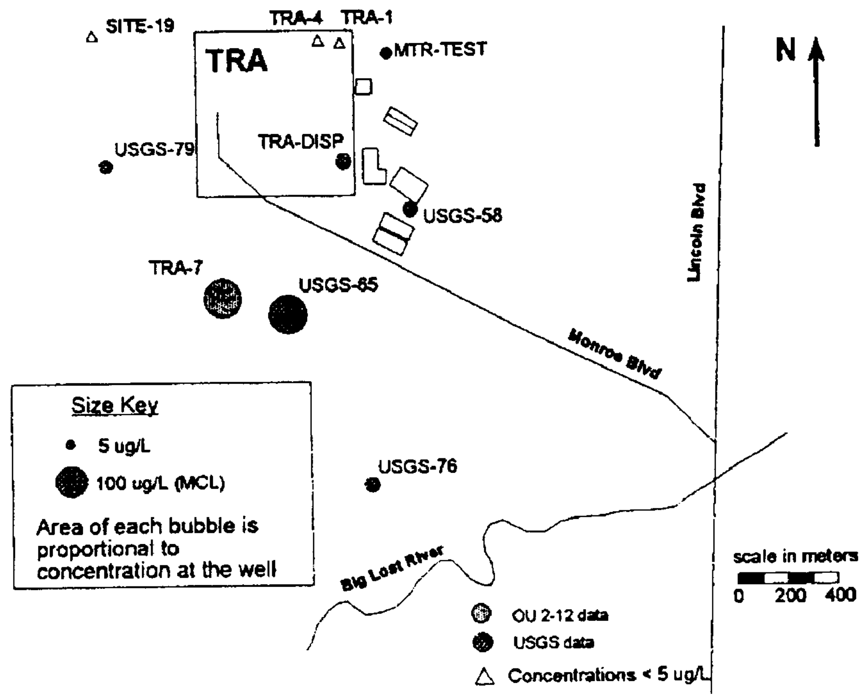

Figure 2-13. Chromium concentrations in the Snake River Plain Aquifer for spring 1995 (Arnett, Meachum, and Jessmore 1996).

During the past three rounds of monitoring, chromium concentrations in the SRPA exceeded the Idaho groundwater quality standard of 100 µg/L in Wells TRA-07 and USGS-65, and in the January 1998 sample from TRA-08. Chromium concentrations in these wells ranged from 157 to 185 µg/L in Well TRA-07, from 46.6 to 107 µg/L in Well TRA-08, and from 166 to 185 µg/L in Well USGS-65.

2.2.3 Model Predictions

Two investigations have been performed to determine the impacts from historical wastewater discharge at the TRA on the groundwater quality. The first investigation, performed as part of the OU 2-12 remedial investigation, evaluated the effects from surface wastewater discharge upon the perched groundwater and SRPA (Dames and Moore 1992). The OU 2-12 remedial investigation predicted the future groundwater concentrations near the TRA based on the TARGET computer code. The second groundwater investigation was identified in the OU 2-13 comprehensive remedial investigation and performed during the OU 3-13 Comprehensive Remedial Investigation/Feasibility Study (DOE-ID 1997c). This investigation used the TETRAD computer code to evaluate the effects of chromium and tritium discharge to the TRA disposal well and warm waste pond on the groundwater quality in the SRPA.

2.2.3.1 Operable Unit 2-12 Model Results. During the OU 2-12 remedial investigation, a two-dimensional numerical groundwater flow and contaminant transport model was used to characterize the flow and migration of contaminants between the ponds and the SRPA. The focus of this effort was on the migration of contaminants from the TRA wastewater ponds to the deep-perched water system and from the deep-perched water system to the SRPA. The TARGET computer code (Dames and Moore 1992) was used to simulate the water levels in the wells and was calibrated to historical concentrations of tritium and chromium in the deep-perched water system and SRPA. Then, the model was used to predict concentrations of 13 contaminants in the SRPA through time up to 125 years in the future.

According to the OU 2-12 remedial investigation, the key contaminants in the deep-perched water system include Am-241, arsenic, beryllium, cadmium, Cs-137, chromium, cobalt, Co-60, fluoride, lead, manganese, Sr-90, and tritium. According to the computer modeling, the contaminants that are expected to exceed federal MCLs in the SRPA within the next 125 years—either currently or at any time in the future—include cadmium, chromium, and tritium. The remaining contaminants are retarded to the extent that their concentrations are predicted to be significantly below the Idaho groundwater quality standards.

The model predictions for cadmium, chromium, and tritium for the deep-perched water system and SRPA are provided in Figures 2-14 and 2-15, respectively. According to the OU 2-12 modeling, tritium and chromium concentrations in the SRPA are expected to fall below the associated Idaho groundwater quality standard by the years 2004 and 2016, respectively. The maximum projected cadmium concentration in the SRPA is 15 μg/L in approximately year 2010, followed by a rapid decline. According to Section 6.5.1.2 (page 6-78) of the OU 2-12 Remedial Investigation Report (Dames and Moore 1992), the modeled concentration for cadmium, as well as other contaminants, is probably higher than what will actually occur in the SRPA. This is attributed to the higher-than-normal infiltration (recharge) rate used in the model. The infiltration rate used in the model was 15 cm/yr, compared to a more realistic value of 1.5 to 5 cm/yr. Thus, the modeled cadmium concentration of 15 μg/L is an overestimate and adds to the conservatism of the risk assessment. The actual projected concentration of cadmium would be significantly lower, and might not exceed the MCL of 5 μg/L, if the infiltration rate used in the model was more representative of site conditions.

The contaminant concentrations in Figures 2-14 and 2-15 are the maximum projected concentrations for the deep-perched water system and SRPA, respectively. Therefore, these concentrations represent the upper limit that should be measured during the OU 2-13 groundwater monitoring. Table 2-2 provides the maximum contaminant concentrations for the deep-perched water system and SRPA, as predicted by the OU 2-12 modeling, for the next 5 years.

2.2.4 Operable Unit 3-13 Model Results

The influence of historical chromium and tritium waste disposal to the TRA disposal well and warm waste pond upon the SRPA was performed during the OU 3-13 Comprehensive Remedial Investigation/Feasibility Study (DOE-ID 1997c) using the TETRAD model. Chromium was discharged to the warm waste pond from 1952 through 1963. Beginning in 1964, chromium was discharged to the TRA disposal well until 1972, when chromate was no longer used as a corrosion inhibitor. During the period from 1952 through 1972, it is estimated that approximately 8,070 kg (17,790 lb) and 14,121 kg (31,131 lb) of chromium were discharged to the warm waste pond and TRA disposal well, respectively (DOE-ID 1997c). In addition, approximately 8,920 Ci of tritium was estimated to have been discharged to the warm waste pond from 1952 through August 1993, when a new lined evaporation pond became operational and replaced the former warm waste pond.

The predicted peak concentration contours in the SRPA for chromium are provided in Figure 2-16. Based on modeling results, the maximum peak chromium concentration of 901 μg/L occurred in the early 1970s when chromium was still being discharged to the disposal well. Since then, chromium concentrations in the SRPA have decreased continually; by 1990, only a small area located southwest of the facility still exceeded the Idaho groundwater standard of 100 μg/L. By 2008, chromium concentrations in the SRPA are expected to be below 100 μg/L. Note that this plume is based on modeling predictions and no wells are located within the area of the plume that exceeds 100 μg/L.

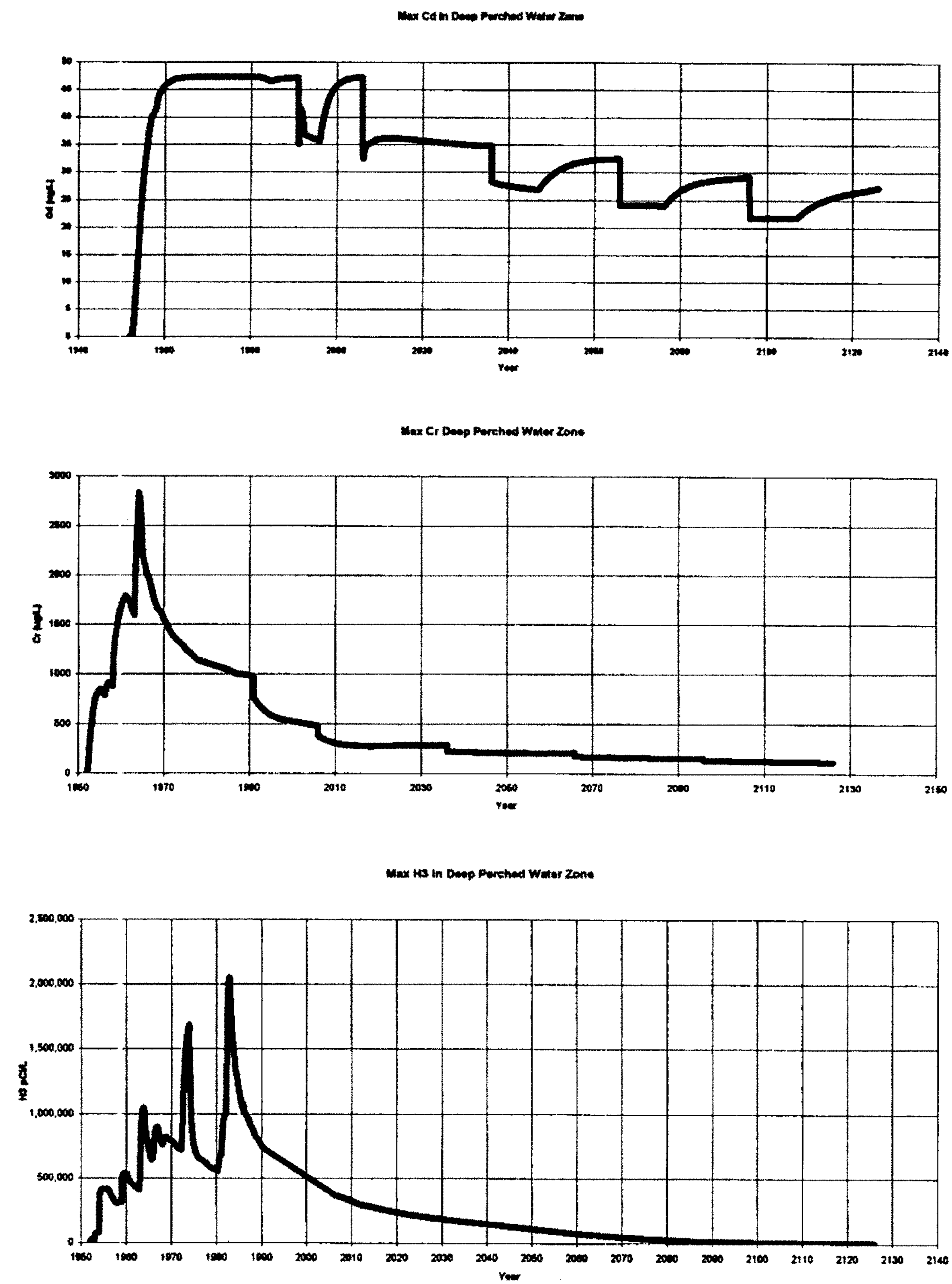

Figure 2-14. Model-simulated cadmium, chromium, and tritium concentrations in the deep-perched water system.

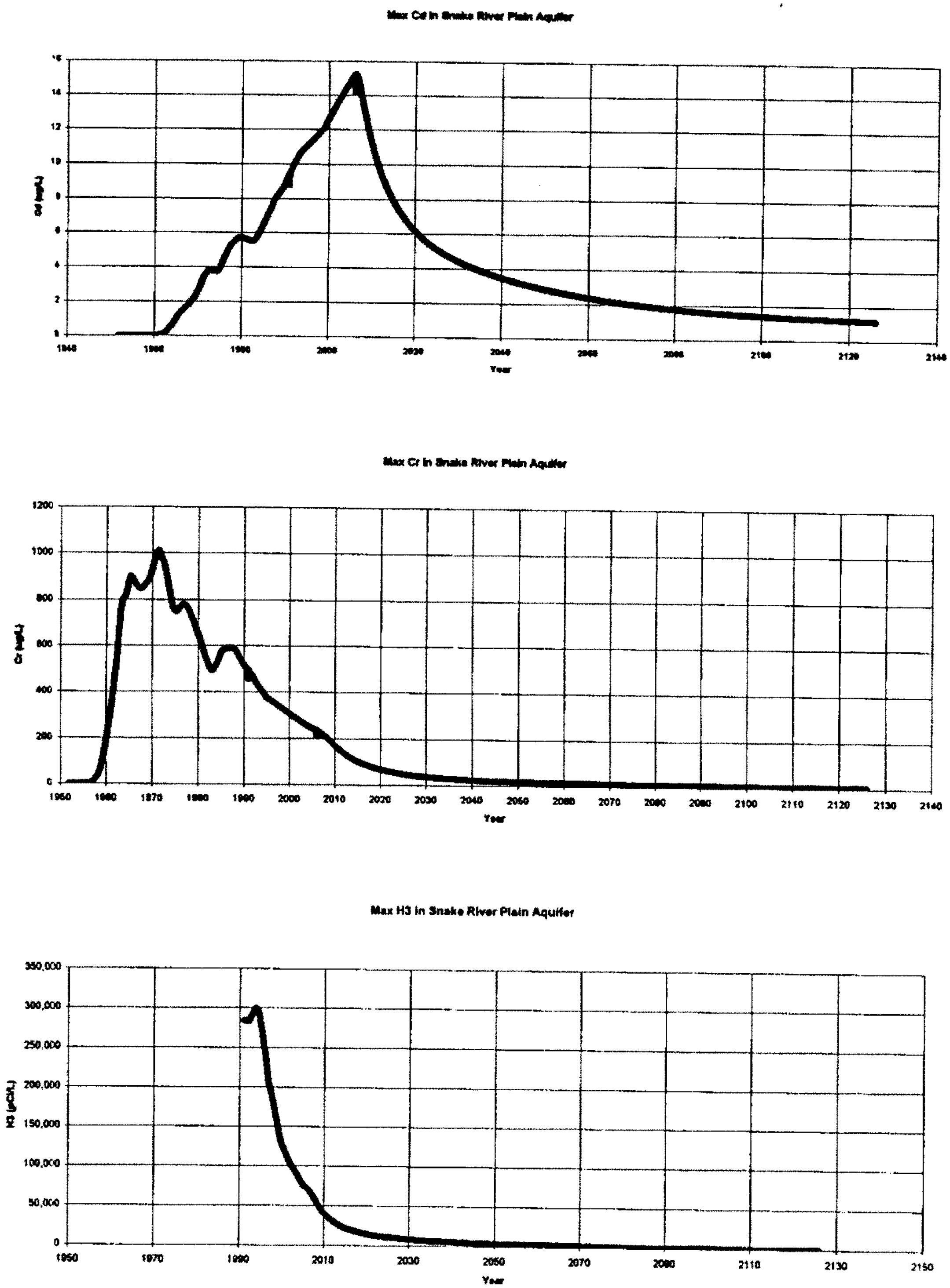

Figure 2-15. Model-simulated cadmium, chromium, and tritium concentrations in the Snake River Plain Aquifer.

Table 2-2. Predicted groundwater concentrations from the Operable Unit 2-12 computer modeling.

	Deep Perched Water System			Snake River Plain Aquifer		
Date	Cadmium µg/L	Chromium µg/L	Tritium pCi/L	Cadmium µg/L	Chromium µg/L	Tritium pCi/L
January 1997	40	552	NA[a]	11.5	350	145,900
July 1997	42	547	NA[a]	11.7	344	134,100
Year 1						
January 1998	43	541	NA[a]	11.8	337	121,000
July 1998	44	537	NA[a]	11.9	330	107,300
Year 2						
January 1999	45	532	NA[a]	12.1	323	93,900
July 1999	45	528	NA[a]	12.4	316	83,500
Year 3						
January 2000	46	524	NA[a]	12.6	309	75,000
July 2000	46	520	NA[a]	12.8	302	69,000
Year 4						
January 2001	46	517	NA[a]	13.1	295	63,000
July 2001	47	513	NA[a]	13.3	288	57,100
Year 5						
January 2002	47	509	NA[1]	13.6	281	52,200
July 2002	47	506	NA[1]	13.8	275	48,500

a. Tritium data are not available from 1990 to 2006 where the maximum concentration in the deep-perched water system is 376,900 pCi/L. Data plotted in Figure 2-14 are a straight-line approximation during this period.

For tritium, the predicted peak concentration contours in the SRPA are provided in Figure 2-17. Based on modeling results, the maximum peak tritium concentration of 297,000 pCi/L also occurred in the early 1970s during a period of increased tritium discharge to the warm waste pond. Since then, tritium concentrations in the SRPA have decreased continually; by 1992, only a small area located directly south of the facility still exceeded the Idaho groundwater standard of 20,000 pCi/L. Tritium concentrations within the portion of the plume that exceed the Idaho groundwater standard currently are being monitored by the existing TRA well network.

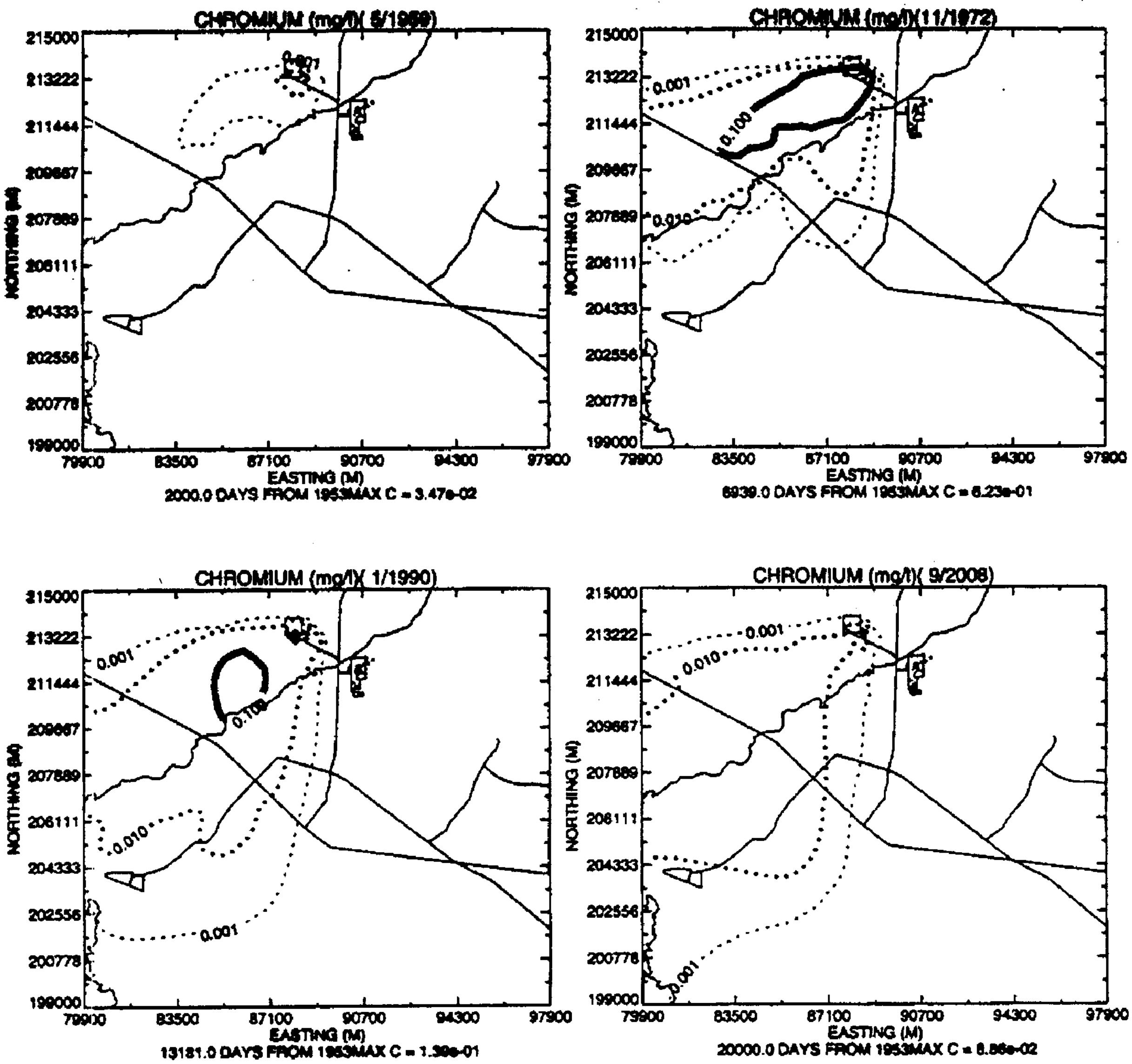

Figure 2-16. Predicted chromium peak concentration contours in the Snake River Plain Aquifer from the Operable Unit 3-13 modeling.

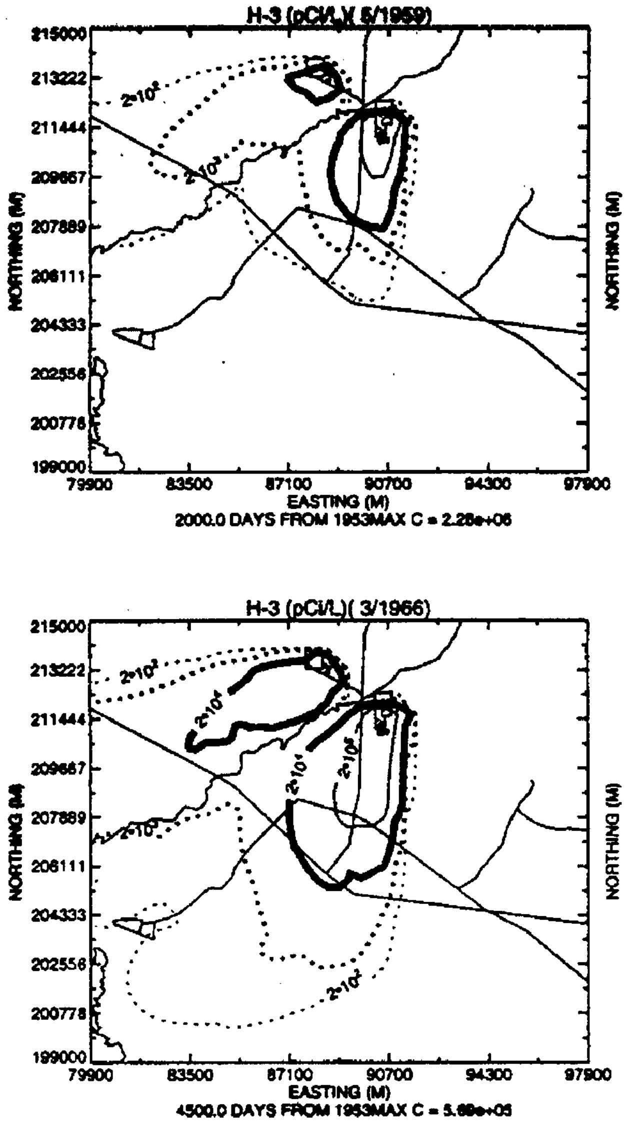

Figure 2-17. Predicated tritium peak concentration contours in the Snake River Plain Aquifer from the Operable Unit 3-13 modeling.

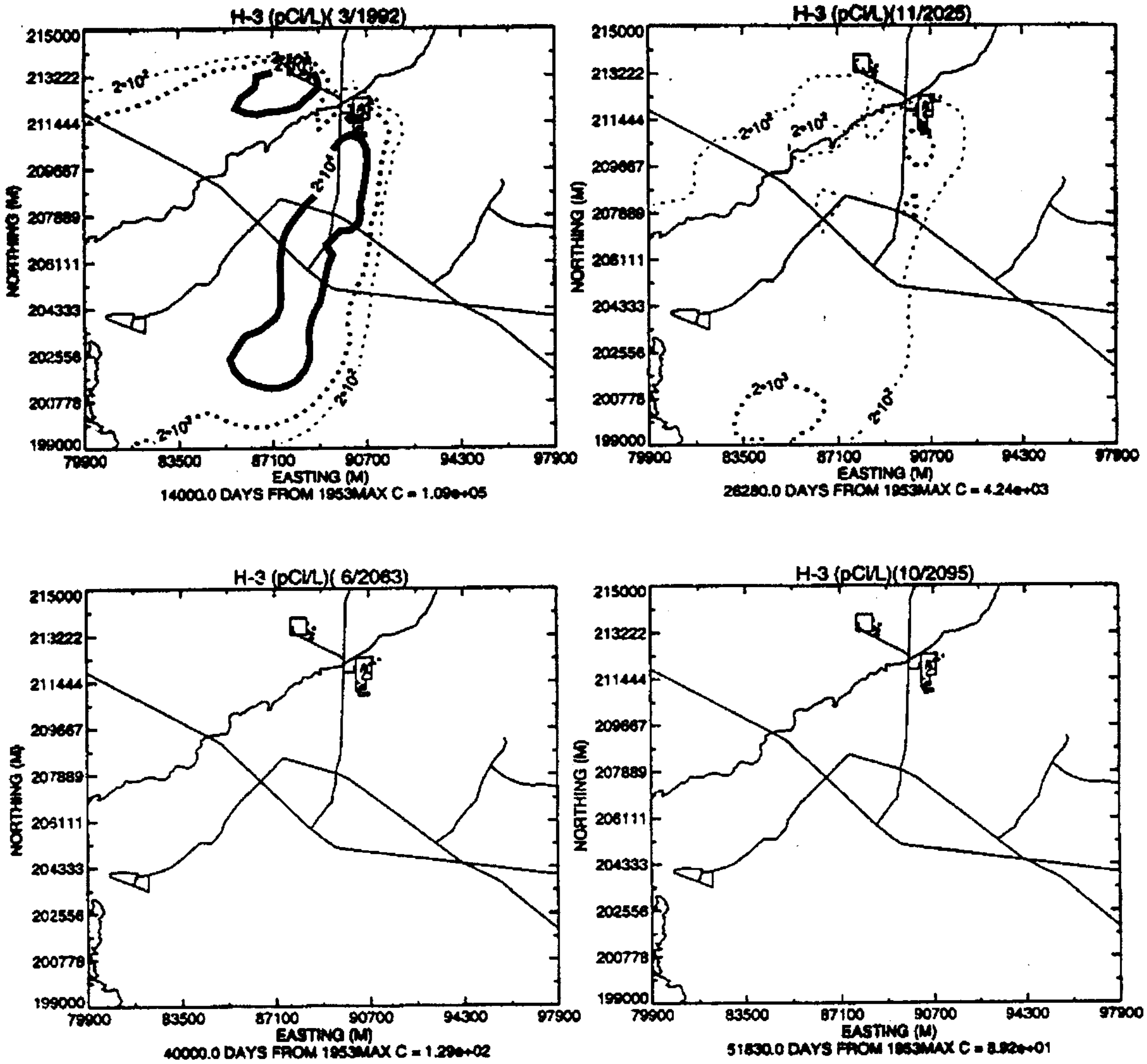

Figure 2-17. (continued).

3. SAMPLING OBJECTIVES

Groundwater monitoring will be performed to meet the post-ROD monitoring requirements, as stated in the OU 2-13 ROD (DOE-ID 1997a). This includes integration of the monitoring requirements of the OU 2-12 ROD (DOE-ID 1992) with the additional monitoring needs for the OU 2-13 ROD (DOE-ID 1997a). In general, the results from this groundwater monitoring will be used to:

- Verify the accuracy of the contaminant concentration trends in the SRPA predicted by computer modeling
- Evaluate the effects that discontinued discharge to the former warm waste pond have on the contaminant concentrations in the deep-perched water system and SRPA
- Meet the groundwater-monitoring requirements identified in both the OU 2-12 and OU 2-13 RODs (DOE-ID 1992, 1997a).

The specific objectives for the OU 2-13 groundwater monitoring, the reference in the ROD that establishes the data requirement, and the associated data collection activity are identified in Table 3-1. The data quality objectives—including data use, measurement, and analytical methods—are identified in Table 3-2.

Mercury will remain in the chemical waste pond and will be covered with a native soil cap, based on the data obtained from the post-ROD sampling event. Long-term monitoring will be required, since mercury will remain in place. Mercury has been included as a potential contaminant for the deep-perched water system.

3.1 Data Needs

3.1.1 Well Selection

During the OU 2-12 remedial investigation, wells near TRA were evaluated for inclusion in the monitoring well network for the post-ROD monitoring activities. Existing well construction data and information regarding historical well uses and contamination history were assessed for both the deep-perched water system and SRPA wells. Then, these data were assessed to select the appropriate wells to monitor water quality in support of the OU 2-12 ROD (Dames and Moore 1993).

The OU 2-12 Post ROD Monitoring Plan required that annual technical memoranda be prepared during the 3-year monitoring period to formally present and evaluate the data collected under the auspices of the plan. Future monitoring then was to be based on an evaluation of data from the 3-year monitoring period and the results of the OU 2-13 Comprehensive Remedial Investigation/Feasibility Study (DOE-ID 1997b). Therefore, the wells selected for inclusion in the Groundwater Monitoring Plan are based on the OU 2-12 Post ROD Monitoring Plan (Dames and Moore 1993), the OU 2-13 Comprehensive Remedial Investigation/Feasibility Study (DOE-ID 1997b), and the Third Annual Technical Memorandum (Arnett, Meachum, and Jessmore 1996).

The wells to be included in the OU 2-13 post-ROD monitoring and the rationale for selection are identified in Table 3-3. The locations for the wells completed in the deep-perched water system and SRPA are shown in Figures 2-5 and 2-6, respectively. To meet the post-ROD monitoring objectives, seven wells completed in the deep-perched water system and six wells completed in the SRPA were selected for inclusion in the monitoring network. Three of the deep-perched water system wells—PW-11, PW-12, and PW-14—were installed in 1990. The other deep-perched water system wells—USGS-53, USGS-54, USGS-55, and USGS-56—were installed in 1960. Monitoring of these deep-perched water system wells will aid in evaluating effects from cessation of waste discharge to the warm waste pond, which occurred in 1993.

Table 3-1. Objectives for Operable Unit 2-13 post-Record of Decision groundwater monitoring.

Requirement	Data Need	Data Gap	Activities
OU 2-12 ROD (DOE-ID 1992), pg. 32—"Because this conclusion [no action] is based on predictive computer modeling, water quality monitoring activities will be conducted to evaluate the contaminant concentration trends in the Snake River Plain Aquifer." OU 2-13 ROD (DOE-ID 1997a), pg. 8-1—"Under this alternative, groundwater monitoring will be continued to ensure that groundwater concentrations do not increase to unacceptable levels and that modeling prediction remain [sic] valid."	The OU 2-12 remedial investigation identified 13 potential contaminants of concern in the groundwater that could impact the SRPA. Based on the groundwater modeling, only Sr-90, cadmium, chromium, and tritium concentrations were predicted to attain peak concentrations within the next 125 years. Of these contaminants, cadmium, chromium, and tritium concentrations are above, or are predicted to be above, the federal MCLs in the SRPA.	Future analytical data that the 13 potential contaminants of concern do not impact the SRPA as predicted by OU 2-12 groundwater model. Future analytical data for comparison to the OU 2-12 groundwater model on those contaminants that exceed, or are predicted to exceed, federal MCLs.	Once at the end of the 5-year period, sample the SRPA wells[a] for the 13 contaminants of concern.[b] On a semiannual basis, sample the SRPA wells[a] for the contaminants in the groundwater that exceed, or are predicted to exceed, the federal MCLs. These contaminants include cadmium, chromium, Sr-90, and tritium.
OU 2-12 ROD (DOE-ID 1992), pg. 32—"Because this conclusion [no action] is based on predictive computer modeling, water quality monitoring activities will be conducted to evaluate the effect of discontinued discharge to the warm waste pond and fate of contaminants in the Perched Water System." OU 2-13 ROD (DOE-ID 1997a), pg. 8-1—"Under this alternative, groundwater monitoring will be continued to ensure that groundwater concentrations do not increase to unacceptable levels and that modeling prediction remain [sic] valid."	The OU 2-12 remedial investigation identified 13 potential contaminants of concern in the perched water system that resulted from wastewater discharge to the warm waste pond. Of these contaminants in the deep-perched water system, chromium, Sr-90, and tritium concentrations exceeded federal MCLs. The contaminant concentrations in the deep-perched water system directly affect the associated concentrations in the SRPA.	Future analytical data on the fate of the 13 potential contaminants in the deep-perched water system. Future analytical data for comparison to the OU 2-12 groundwater model on those contaminants that exceed, or are predicted to exceed, federal MCLs.	Once at the end of the 5-year period, sample the deep-perched water system wells[c] for the 13 contaminants of concern.[b] On a semiannual basis, sample the deep-perched water system wells[c] for the contaminants in the groundwater that exceed, or are predicted to exceed, the federal MCLs. These contaminants include cadmium, chromium, Sr-90, and tritium. Once the end of the 5-year period, measure water levels in all the deep-perched water system wells (not just the wells being sampled).

Table 3-1. (continued).

Requirement	Data Need	Data Gap	Activities
OU 2-13 ROD (DOE-ID 1997a), pg. ix—"Groundwater monitoring will be conducted to verify that contaminant concentration trends follow those predicted by the (OU 2-12 and OU 2-13) groundwater model(s)."	Data needs for the OU 2-12 groundwater modeling are identified above. The OU 3-13 groundwater modeling identified a potential chromium plume that extends southwest of TRA and beyond the existing monitoring well network. By the year 2008, the chromium concentrations within this plume are expected to be below federal MCLs.	Future analytical data concerning the downgradient extent of this chromium plume.	On a semiannual basis, collected water samples for chromium analysis from Monitoring Well Hwy-3. This is the nearest downgradient well completed in the SRPA from the chromium plume.
OU 2-13 ROD (DOE-ID 1997a), pg. 8-2—"Environmental monitoring (of mercury contamination in the chemical waste pond) would be maintained for at least 100 years."	The OU 2-13 remedial action will leave mercury-contaminated sediments in the chemical waste pond. Data need is to determine whether mercury migrates to the deep-perched water system.	Future analytical data concerning potential migration of mercury contamination to the groundwater.	On an annual basis, sample the deep-perched water system well (PW-14) that is located closest to the chemical waste pond for mercury.
OU 2-13 ROD (DOE-ID 1997a)—"Five year reviews will be used to evaluate the effectiveness and appropriateness of these alternatives."	Sufficient analytical data and associated interpretation to determine the effectiveness of the remedial actions upon the groundwater quality.	Future analytical data reporting and sufficient technical interpretation to enable the Agencies to perform the 5-year review.	Analytical data will be submitted to the Agencies in accordance with the schedule identified in the Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory (DOE-ID 1991). A technical report will be prepared at the end of the 5-year monitoring period that summarizes the data and evaluates the effectiveness of the OU 2-12 and OU 2-13 remedial actions upon the groundwater quality at the TRA.

Table 3-1. (continued).

Requirement	Data Need	Data Gap	Activities

a. Wells completed in the SRPA include TRA-06, TRA-07, TRA-08, USGS-58, and USGS-65.

b. Potential contaminants of concern include arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, fluoride, Co-60, Cs-137, Am-241, Sr-90, and tritium.

c. Wells completed in the deep-perched water system include PW-11, PW-12, USGS-53, USGS-54, USGS-55, and USGS-56.

DOE-ID = U.S. Department of Energy Idaho Operations Office
MCL = maximum contaminant level
OU = operable unit
ROD = Record of Decision
SRPA = Snake River Plain Aquifer
USGS = United States Geological Survey

Table 3-2. Data quality objectives, contaminants, and analytical methods for the Operable Unit 2-13 groundwater monitoring.

Objective	Data Use	Analyte	Method	Required Detection Limits (μg/L or pCi/L)	Water Quality Standarda
Groundwater monitoring to ensure that contaminant concentrations do not increase to unacceptable levels and that contaminant concentration trends in the SRPA follow that predicted by the OU 2-12 computer model.	Determine contaminant concentrations in the SRPA for the 5-year review. Contaminant concentrations will be determined at the following frequency: 1. All contaminant concentrations will be measured once every 5 years. 2. Key contaminants (cadmium, chromium, tritium, and Sr-90) will be measured semiannually.	Arsenic	GFAAb	10	50 μg/L
		Beryllium	GFAAb	0.8	4 μg/L
		Cadmium	GFAAb	2	5 μg/L
		Chromium	ICPc	10	100 μg/L
		Cobalt	ICPc	50	Not available
		Lead	GFAAb	3	15 μg/L
		Manganese	ICPc	10	50 μg/L
		Fluoride	ICd	100	4,000 μg/L
		Cobalt-60	Gamma spectrometry	30	4 mrem/yr
		Cesium-137	Gamma spectrometry	30	4 mrem/yr
		Americium-241	Alpha spectrometry	0.2	4 mrem/yr
		Strontium-90	Gas-flow proportional counting	1	8 pCi/L
		Tritium	Liquid scintillation counting	400	20,000 pCi/L
Groundwater monitoring to evaluate the fate of contaminants in the perched water system and to ensure that contaminant concentrations in the deep-perched water system do not increase to unacceptable levels.	Determine contaminant concentrations in the SRPA for the 5-year review. Contaminant concentrations will be determined at the following frequency: 1. All contaminant concentrations will be measured once every 5 years. 2. Key contaminants (cadmium, chromium, tritium, and Sr-90) will be measured semiannually.	Arsenic	GFAAb	10	50 μg/L
		Beryllium	GFAAb	0.8	4 μg/L
		Cadmium	GFAAb	2	5 μg/L
		Chromium	ICPc	10	100 μg/L
		Cobalt	ICPc	50	Not available
		Lead	GFAAb	3	5 μg/L
		Manganese	ICPc	10	50 μg/L
		Fluoride	ICd	100	4,000 μg/L
		Cobalt-60	Gamma spectrometry	30	4 mrem/yr
		Cesium-137	Gamma spectrometry	30	4 mrem/yr
		Americium-241	Alpha spectrometry	0.2	4 mrem/yr
		Strontium-90	Gas-flow proportional counting	1	8 pCi/L
		Tritium	Liquid scintillation counting	400	20,000 pCi/L

Table 3-2. (continued).

Objective	Data Use	Analyte	Method	Required Detection Limits (µg/L or pCi/L)	Water Quality Standard[a]
Groundwater monitoring to ensure that the OU 2-13 predicted chromium plume above MCLs does not migrate further downgradient.	Determine chromium concentrations in the SRPA downgradient of the OU 2-13 predicted chromium plume for the 5-year review. Water samples will be collected on a semiannual basis from the Hwy-3 well and analyzed for chromium.	Chromium		10	100 µg/L
Groundwater monitoring to evaluate potential mercury migration from the chemical waste pond.	Determine mercury concentrations in the deep-perched water system near the chemical waste pond for the 5-year review. Water samples will be collected on an annual basis from Well PW-14.	Mercury		0.2	2 µg/L

a. Water quality standards are based on the Idaho Groundwater Quality Rule (IDAPA 16.01.11.200).

b. Graphite furnace atomic adsorption.

c. Inductively coupled plasma.

d. Ion chromatograph.

IDAPA = Idaho Administrative Procedures Act
MCL = maximum contaminant level
OU = operable unit
SRPA = Snake River Plain Aquifer

Table 3-3. Monitoring wells included in the Operable Unit 2-13 post-Record of Decision monitoring.

Well	Hydrologic Unit	Rationale	Comments
PW-11	Deep-perched water system	Well PW-11 is located in the north-central portion of the deep-perched water system, directly opposite the warm waste pond (64 Cell) from the cold waste pond. Based on water-level contours from the deep-perched water system, the well is situated to monitor potential contaminant migration from the warm waste pond (64 Cell). During the January 1998 sampling event, tritium was detected at a concentration of 73,500 pCi/L, which exceeds the Idaho groundwater quality standard (IDAPA 16.01.11.200).	
PW-12	Deep-perched water system	Well PW-12 is located in the center of the TRA and on the western portion of the deep-perched water system. Based on water-level contours of the deep-perched water system, the well is situated to monitor potential contaminant migration from the retention basin and other sites located in southeastern TRA (soil surrounding hot waste tanks at TRA-613 [TRA-15], soil surrounding Tanks 1–2 at TRA-630 [TRA-19], and the Brass Cap Area). During the January 1998 sampling event, Sr-90 was detected at a concentration of 50.1 pCi/L, which exceeds the Idaho groundwater quality standard (IDAPA 16.01.11.200).	
PW-14	Deep-perched water system	Well PW-14 is located at the northern extent of the deep-perched water system, directly north of the chemical waste pond. Based on water-level contours from the deep-perched water system, the well is situated to monitor potential contaminant migration from the chemical waste pond. During March 1991, no contaminants were identified above the Idaho groundwater quality standards (IDAPA 16.01.11.200).	
USGS-53	Deep-perched water system	Well USGS-53 is located in the central portion of the deep-perched water system, directly to the southwest of the warm waste pond (57 Cell). Based on water-level contours from the deep-perched water system, the well is situated to monitor potential contaminant migration from the warm waste pond (52 and 57 Cells). In addition, the well was used for the intermittent disposal of wastewater during the late 1960s and early 1970s. During the October 1995 sampling event, chromium (599 μg/L), Sr-90 (135 pCi/L), and tritium (130,000 pCi/L) were detected at concentrations that exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200).	Well USGS-53 has been dry during the past three sampling events due to decreased surface water discharge at the TRA. The last successful sample was collected during October 1995.
USGS-54	Deep-perched water system	Well USGS-54 is located in the central portion of the deep-perched water system, directly adjacent to the warm waste pond (64 Cell) and north of the cold waste pond. Based on its proximity to the cold waste pond and the elevated water levels, it appears that this well is highly influenced by surface water discharge to the cold waste pond. Although significantly impacted by discharge to the cold waste pond, USGS-54 is situated to monitor potential contaminant migration from the warm waste pond (64 Cell). During the January 1998 sampling event, Sr-90 was detected at a concentration of 70.8 pCi/L, which exceeds the Idaho groundwater quality standard (IDAPA 16.01.11.200).	

Table 3-3. (continued).

Well	Hydrologic Unit	Rationale	Comments
USGS-55	Deep-perched water system	Well USGS-55 is located in the northern portion of the deep-perched water system, between the warm waste pond (52 Cell) and the sewage leach pond. Based on water-level contours from the deep-perched water system, the well is situated to monitor potential contaminant migration from the warm waste pond (52 Cell) and the sewage leach pond. During the January 1998 sampling event, Sr-90 (11.8 pCi/L) and tritium (98,400 pCi/L) were detected at concentrations that exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200).	
USGS-56	Deep-perched water system	Well USGS-56 is located in the northern portion of the deep-perched water system, northwest of the warm waste pond (52 Cell). Based on water-level contours from the deep-perched water system, the well is situated to monitor potential contaminant migration from the warm waste pond (52 Cell). During the January 1997 sampling event, chromium (110 µg/L), cobalt-60 (200 pCi/L), Sr-90 (18.2 pCi/L), and tritium (211,000 pCi/L) were detected at concentrations that exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200).	Well USGS-56 has been dry during the past two sampling events due to decreased surface water discharge at the TRA. The last successful sample was collected during January 1997.
Hwy-3	SRPA	Well Hwy-3 is located approximately 3 mi southwest of TRA in the direction of the regional groundwater flow. According to the OU 3-13 groundwater modeling, this well is located downgradient from a potential chromium plume that resulted from past wastewater discharge to the TRA disposal well and warm waste pond. It is completed at approximately 46 m (150 ft) below the water table, which corresponds to the depth where the majority of contamination was discharged to the TRA disposal well. Based on the OU 3-13 modeling, it is not expected that chromium concentrations in this well will be detected above the Idaho groundwater quality standards (IDAPA 16.01.11.200).	
TRA-06	SRPA	Well TRA-07 is located adjacent to USGS-65 and completed at approximately 21 m (70 ft) below the water table in the SRPA. It was installed to determine whether the upper portion of the aquifer being monitored by USGS-65 is representative of the entire aquifer. During the January 1998 sampling event, no contaminants were detected at concentrations that exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200).	
TRA-07	SRPA	Well TRA-07 is completed in the upper 6 m (20 ft) of the SRPA and located downgradient of the facility and the southern extent of the deep-perched water system. Based on the regional groundwater flow direction to the southwest, this well is situated to monitor contamination from the perched groundwater and TRA disposal well. During the January 1998 sampling event, chromium (170 µg/L) and tritium (23,500 pCi/L) were detected at concentrations that exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200).	

Table 3-3. (continued).

Well	Hydrologic Unit	Rationale	Comments
TRA-08	SRPA	Well TRA-08 is completed in the upper 6 m (20 ft) of the SRPA and located approximately 914 m (3,000 ft) south of the TRA. Based on a regional groundwater flow direction toward the southwest, it is located downgradient from the facility and Monitoring Wells TRA-07 and USGS-65. It is located in an area where the chromium and tritium plumes from the TRA are near the Idaho groundwater quality standards (IDAPA 16.01.11.200) and will help bound the extent of the plume migrating from the TRA. During the January 1998 sampling event, chromium (107 μg/L) was detected at a concentration that exceeded the Idaho groundwater quality standard (IDAPA 16.01.11.200).	
USGS-58	SRPA	Well USGS-58 is completed in the upper 12 m (40 ft) of the SRPA and located in the center of the deep-perched water system, between the warm waste pond and the cold waste pond. Given the regional groundwater flow to the southwest, this well is located cross gradient from the facility and potentially only monitors a portion of the deep-perched water system water entering the SRPA. During the January 1998 sampling event, no contaminants were detected at concentrations that exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200).	Construction details indicate that USGS-58 is an open hole from 66 to 153 m (218 to 503 ft). Located within the deep-perched water system, it is likely that perched water is migrating down the borehole to the SRPA. This condition presents the problem of uncertainty of the water quality results to accurately represent the SRPA.
USGS-65	SRPA	Well USGS is completed in the upper 9 m (30 ft) of the SRPA and located directly downgradient from the disposal ponds and the southern extent of the deep-perched water system. Historically, chromium and tritium concentrations have exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200). During the January 1998 sampling event, chromium (171 μg/L) exceeded the Idaho groundwater quality standards (IDAPA 16.01.11.200).	Construction complies with all applicable standards.

IDAPA = Idaho Administrative Procedures Act
OU = operable unit
SRPA = Snake River Plain Aquifer
TRA = Test Reactor Area
USGS = United States Geological Survey

The six SRPA wells selected for inclusion into the sampling network are Hwy-3, TRA-06, TRA-07, TRA-08, USGS-58, and USGS-65. Three of these wells (TRA-07, USGS-58, and USGS-65) were included in the original OU 2-12 post-ROD monitoring. The addition of TRA-06 and TRA-08 to the post-ROD monitoring network was recommended during the Third Annual Technical Memorandum (Arnett, Meachum, and Jessmore 1996). The Hwy-3 well was added to the post-ROD monitoring network based on the results from the OU 3-13 groundwater modeling.

The TRA-03 and TRA-04, which were production wells used for both industrial and drinking water purposes, are located upgradient of contamination in the SRPA beneath TRA and will not be sampled as part of the post-ROD monitoring program. However, data from these wells will be used to supplement the SRPA data set if increases in contaminant concentrations are observed in the network wells.

3.1.2 Monitoring Schedule

Since the early 1960s, the USGS has performed groundwater monitoring on the deep-perched water system and SRPA at the TRA. Their monitoring well network currently includes 18 deep-perched water system wells, which are sampled on a semiannual basis (generally during April and October), and four SRPA wells that are sampled on a quarterly to semiannual basis, depending on the well. The deep-perched water system and SRPA wells sampled by the USGS are identified in Figures 2-5 and 2-6, respectively.

Since 1993, groundwater at the TRA also has been monitored as part of the OU 2-12 post-ROD activities. The results from this monitoring effort were then compared to the concentrations predicted by the OU 2-12 computer modeling (Dames and Moore 1992). According to Arnett, Meachum, and Jessmore (1996), the observed concentrations for the monitored constituents generally have behaved according to the predictions from the OU 2-12 computer model during the 3-year monitoring period. In some SRPA wells, the model-predicted rates of decline for tritium and chromium concentrations were not observed. However, the chromium and tritium concentrations from these wells are below the concentrations predicted by the computer model.

Therefore, the OU 2-13 monitoring schedule is based on the recommendations provided during the 3-year review of the OU 2-12 monitoring, the measured concentrations being below the predicted concentrations based on the OU 2-12 modeling, and that the USGS currently is monitoring groundwater at the TRA. The following strategy was employed to determine the monitoring schedule:

- *Semiannual Monitoring*—Semiannual monitoring will be performed for the contaminants identified above the Idaho groundwater quality standards. This monitoring includes cadmium, chromium, mercury, Co-60, Sr-90, and tritium in the deep-perched water system and chromium and tritium in the SRPA.

- *Annual Monitoring*—Annual monitoring will be performed for the contaminants identified as a concern, but do not exceed the Idaho groundwater quality standards in the given water-bearing unit (e.g., deep-perched water system or SRPA). Monitoring in the deep-perched water system includes mercury. Monitoring in the SRPA includes cadmium, Co-60, and Sr-90.

- *Five-Year Monitoring*—Five-year monitoring will be performed for all the potential contaminants of concern that have been identified in the OU 2-13 comprehensive remedial investigation.

The OU 2-13 monitoring schedule for the next 5 years is provided in Table 3-4. From this monitoring well network, Wells USGS-53 and USGS-56 periodically have been dry. During each sampling event, water levels in each well will be measured to determine whether a sample can be collected successfully. If insufficient water is available in the well, a water sample will not be collected and appropriate notations made in the logbook.

Table 3-4. Operable Unit 2-13 groundwater-monitoring schedule.

Wells	Monitoring Frequency and Constituent		
	Semiannual (For all deep-perched water system wells)	Annual (For all deep-purged water system wells)	5 Years (For deep-purged water system and SRPA wells)
Deep-purged water system Wells:			
PW-11 PW-12 PW-14 [a] USGS-53[a] USGS-54 USGS-55 USGS-56[a]	Cadmium Chromium Mercury Cobalt-60 Strontium-90 Tritium	Americium-241[d] Volatiles and Semivolatiles[e] PAH and BTEX[f]	Americium-24[i] Arsenic Beryllium Cadmium Cesium-137 Chromium Cobalt-60 Fluoride Lead Manganese Strontium-90 Tritium
PW-13	Semiannually, monitor PW-13 using an interface probe to determine the presence and thickness of a floating organic layer.		
SRPA Wells:	(For all SRPA wells) Chromium Tritium	(For all SRPA wells) Cadmium Cobalt-60 Strontium-90	See above.
Hwy-3[b] TRA-06 TRA-07 TRA-08 USGS-58 USGS-65			

a. Wells PW-14, USGS-53, and USGS-56 periodically have been dry, but need to continue to remain in the monitoring cycle to determine if they will stay dry.

b. Since the Hwy-3 well is included in the monitoring network based on the OU 3-13 computer modeling, it will be sampled only for chromium on a semiannual basis.

c. Semiannual means sampling twice a year. Annual means sampling only once per year. However, the semiannual and annual sampling events could occur at the same time.

d. Sampling for Americium-241 will be one time only, in November 2000.

e. Sampling for volatiles and semivolatiles will be one time only, in November 2000.

f. PAH and BTEX—If an oil phase is detected in the perched water wells, a sample will be collected and analyzed for PAH and BTEX; this will be performed one time only, in November 2000.

PAH = polyaromatic hydrocarbon
SRPA = Snake River Plain Aquifer
TRA = Test Reactor Area
USGS = United States Geological Survey

3.1.3 Analytical Methods

According to the OU 2-12 remedial investigation, the key contaminants in the groundwater at TRA include Am-241, arsenic, beryllium, cadmium, Cs-137, chromium, cobalt, Co-60, fluoride, lead, manganese, Sr-90, and tritium. The computer modeling further identified that cadmium, chromium, and tritium are expected to exceed Idaho groundwater quality standards in the SRPA within the next 125 years, either currently or at any time in the future. In addition, Co-60 and Sr-90 presently exceed the Idaho groundwater quality standards for the deep-perched water system.

The analytical methods for the OU 2-13 groundwater monitoring are identified in Table 3-3. These methods were selected because the precision, accuracy, and detection levels are suitable for comparison to the Idaho groundwater quality standards. Inorganic analyses will be performed in accordance with the procedures identified in the "Idaho National Engineering Laboratory Statement of Work for Inorganic and Miscellaneous Classical Analyses" (ER-SOW-156). Radionuclide analyses will be performed in accordance with the procedures identified in the "Idaho National Engineering Laboratory Sample Management Office Statement of Work for Radionuclide Analysis" (ER-SOW-163).

3.1.4 Organic Contamination in Deep-Perched Water System

Organic contamination was discovered in Deep-Perched Water System Well PW-13, in February 2000, and has been observed on an intermittent basis since that time. This contamination is suspected to be diesel fuel due to the past history of this well, and the odor noted while measuring the thickness of the contamination layer is consistent with that assumption. During the November 2000 sampling event, one-time analysis of volatiles and semivolatiles was conducted on all deep-perched water system wells. Analytical results from this sampling event did not indicate the presence of organics in any of the other deep-perched water system wells.

3.2 Quality Assurance Objectives for Measurement

The quality assurance objectives are specifications that the measurements of the contaminant or physical parameters identified in Table 3-2 must meet in order to achieve project objectives. The technical and statistical quality of these measurements must be documented properly. Precision, accuracy, method detection limits, and completeness will be assessed against the data requirements for the measurement in accordance with Section 2.1 of the QAPjP (DOE-ID 2002). A discussion of whether the data requirements of the project have or have not been meet will be included in the 5-year technical memorandum.

3.3 Data Validation

Ten percent of laboratory-generated data collected in support of the post-ROD monitoring will be validated to Level A in accordance with Guide (GDE) -7003, "Levels of Analytical Method Data Validation." The remaining 90% of the laboratory-generated data, not validated to Level A, will be validated to Level C in accordance with GDE-7003.

3.4 Data Reporting

Operable Unit 2-13 post-ROD monitoring activities will be reported in accordance with the requirements set forth in the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991), the *Remedial Design and Remedial Action Guidance for the Idaho National Engineering Laboratory* (RUST Geotech Inc. 1994), and the OU 2-13 ROD (DOE-ID 1997a). Quality-assured data collected during the monitoring will be submitted no later than 120 days from the time of collection. Graphical presentation of the data will be provided that includes the historical groundwater concentrations. Other data collected, which do not require quality assurance (such as groundwater elevations), will be submitted along with the quality-assured data.

The annual technical memoranda, identified under the OU 2-12 Groundwater Monitoring Plan, will no longer be prepared because only a limited amount of new data is being collected on a yearly basis. Typically, the annual data will include only one or two additional contaminant concentrations per well, depending on the analyte. However, data summary submittals and updates of information will be transmitted on the status of trending data in the form of an interim report. The interim report will be issued, as deemed necessary, to update the Agencies with project data. If the contaminant concentrations significantly deviate from what was expected during the 5-year monitoring period, then a technical memorandum can be requested by the project managers (PMs) to address this deviation. Otherwise, a technical memorandum will be prepared at the end of the 5-year monitoring period, which describes the results of groundwater monitoring and will include, at a minimum, the following items:

- Identification of all contaminants exceeding the standards identified in the Idaho Groundwater Quality Rule (IDAPA 16.01.11.200)
- Discussion of the measured contaminant concentrations with regard to the model-predicted concentrations
- Discussion of data trends and predicted future concentrations for the next 5-year monitoring period
- Discussion of the overall hydrogeologic setting, including water sources, water-level fluctuations, extent of perched water, etc.
- Identification of any additional contaminant sources that might impact the groundwater quality
- Recommended changes to the groundwater-monitoring program (analytes, location, and frequency).

4. PROJECT ORGANIZATION AND RESPONSIBILITY

The organizational structure for this work reflects the resources and expertise required to perform the work while minimizing risks to worker health and safety. The following sections outline responsibilities of key site personnel.

4.1 Environmental Restoration Director

The Environmental Restoration (ER) director has ultimate responsibility for all project technical quality and personnel safety during field activities performed by or for the ER Program.

The ER director provides technical coordination and interfaces with the U.S. Department of Energy Idaho Operations Office (DOE-ID) Environmental Support Office. The ER director ensures that:

- All activities are conducted in accordance with the Occupational Safety and Health Administration, U.S. Department of Energy, EPA, and Idaho Department of Environmental Quality requirements and agreements
- Program budgets and schedules are monitored and approved
- Availability of necessary personnel, equipment, subcontractors, and services is provided
- Direction for the development of tasks, evaluation of findings, development of conclusions and recommendations, and production of reports is provided.

4.2 Environmental Restoration Environment, Safety, and Health Compliance Officers

The ER environment, safety, and health (ES&H) compliance officers are responsible for ensuring that ES&H oversight is provided for all ER programs and projects. These positions report to and are accountable to the ER director. The ER ES&H compliance officers perform line management review, inspections, and oversight in compliance with Management Control Procedure (MCP) -3562, "Hazard Identification, Analysis, and Control of Operational Activities," and Program Requirements Document (PRD) -25, "Activity Level Hazard Identification, Analysis, and Control." Project or program management shall bring all ES&H concerns, questions, comments, and disputes to the ER ES&H compliance officers that cannot be resolved by the health and safety officer (HSO) or one of the assigned ES&H professionals.

4.3 Project Management Team

The PM is responsible for overseeing all administrative activities conducted during the project, including providing notification to the facility representative of all work activities. Ultimate responsibility for the management of waste generated because of this project's activities lies with the PM.

The PM is responsible for ensuring that all activities conducted during the project are in compliance with company procedures, all MCPs and PRDs, and all applicable Occupational Safety and Health Administration, EPA, U.S. Department of Energy, U.S. Department of Transportation (DOT), and State of Idaho requirements.

The PM is responsible for ensuring that tasks comply with the QAPjP, FSP, Health and Safety Plan (HASP), and all supporting documentation associated with the project. The PM coordinates all field, laboratory, and modeling activities and may delegate any or all the above responsibilities.

4.4 Health and Safety Officer

The HSO is the person located at the work site who serves as the primary contact for health and safety issues. The HSO advises the sampling field team leader (FTL) on all aspects of health and safety and is authorized to stop work at the site if any operation threatens worker or public health and safety. The HSO has other specific responsibilities, as stated in other sections of the project HASP. The HSO is authorized to verify compliance to the HASP, conduct conformance inspections, require and monitor corrective actions, and monitor decontamination procedures and require corrections (as appropriate). The HSO is supported by other health and safety personnel at the work site (safety engineer, industrial hygienist [IH], radiological control technician [RCT], radiological engineer, and facility representative), as necessary.

Personnel that will serve as the HSO or alternate HSO must be qualified to recognize and evaluate hazards and have the authority to take or direct actions to ensure that workers are protected. The HSO also may be the IH, safety engineer, or, in some cases, the sampling FTL depending on the hazards, complexity, and size of the activity involved. Concurrence from the ER ES&H manager or designee at the site is required for delegation of the HSO's responsibilities. Other work site responsibilities of the HSO must not conflict (philosophically or in terms of significant added volume of work) with the role of the HSO at the work site.

If it is necessary for the HSO to leave the site, an alternate individual will be appointed by the HSO to fulfill this role, and the identity of the acting HSO will be recorded in the sampling FTL logbook.

4.5 Industrial Hygienist

The IH is the primary source of information regarding nonradiological hazardous and toxic agents at the work site. The IH will be present at the task site during any work operations when a chemical hazard to Operations personnel might exist or is anticipated. The IH assesses the potential for worker exposures to hazardous agents in accordance with company procedures and *Manual 14A–Safety and Health–Occupational Safety and Fire Protection* and *Manual 14B–Safety and Health–Occupational Medical and Industrial Hygiene.* The IH assesses and recommends appropriate hazard controls for protection of work site personnel, reviews the effectiveness of monitoring and personal protective equipment (PPE) required in the project HASP, and recommends changes (as appropriate). Following an evacuation, the IH will assist in determining whether conditions at the task site are safe for reentry. Employees showing health effects resulting from possible exposure to hazardous agents will be referred to the Occupational Medical Program by the IH, their supervisor, or the HSO. The IH may have other duties at the task site, as specified in other sections of the project HASP or in company procedures and manuals. During emergencies involving hazardous materials, industrial hygiene measurements will be performed by members of the Emergency Response Organization.

4.6 Radiological Control Technician

The RCT is the primary source of information and guidance on radiological hazards. The RCT will be present at the task site during any work operations when a radiological hazard to Operations personnel might exist or is anticipated. Responsibilities of the RCT include performing radiological surveying of the work site, equipment, and samples; providing guidance for radiological decontamination of equipment and personnel; and accompanying the affected personnel to the nearest INEEL medical facility for evaluation if significant radiological contamination occurs. The RCT must notify the sampling FTL of any radiological occurrence that must be reported as directed by *Manual 15A–INEEL Radiological Control Manual*. The RCT may have other duties at the work site, as specified in other sections of the project HASP and FSP or in company procedures and manuals.

4.7 Field Team Leader

The FTL has ultimate responsibility for the safe and successful completion of the sampling project. The FTL manages field operations and executes the FSP, enforces site control and documents work site activities, and conducts daily safety briefings. Additional responsibilities include, but are not limited to, the following:

- Technical and operational requirements of the sampling activities
- Field analysis and decontamination activities
- Equipment removal procedures
- Packaging and shipping samples
- Safety of personnel conducting these activities.

The FTL also will assume the duties of the HSO, if the HSO is not present at the job site. These responsibilities may be transferred to a designated representative meeting all FTL training requirements. The sampling FTL may be a member of the sampling team. All health and safety issues at the work site must be brought to the attention of the sampling FTL.

4.8 Quality Assurance Engineer

The quality assurance engineer provides guidance on task-site quality issues, when requested. The quality assurance engineer observes task site activities and verifies that task site operations comply with quality requirements pertaining to these activities. The quality assurance engineer identifies activities that do not comply or are potentially noncompliant with quality requirements and suggests corrective actions.

4.9 Sampling Team

The sampling team will perform the onsite tasks necessary to collect the samples. Team members will not enter the sampling area alone. The sampling team will consist of a minimum of two members, and the buddy system will be implemented. An RCT or IH will support the team on an as-needed basis.

4.10 Sampling and Analysis Management

The INEEL Sampling and Analysis Management Department (formerly the Sample Management Office) is responsible for obtaining necessary laboratory services as required and ensuring that data generated from samples collected and analyzed meet the needs of the project, thereby validating all analytical laboratory data according to resident protocol.

The Sampling and Analysis Management-contracted laboratory will have overall responsibility for laboratory technical quality, laboratory cost control, laboratory personnel management, and adherence to agreed-upon laboratory schedules. Responsibilities of the laboratory personnel include preparing analytical reports, ensuring that chain-of-custody information is complete, and ensuring that all quality assurance/quality control procedures are implemented in accordance with Sampling and Analysis Management-generated task order statements of work (SOWs) and master task agreements.

5. SAMPLING LOCATION AND FREQUENCY

The material presented in this section is intended to support the data quality objectives summarized in Section 3. The sampling and analysis plan (SAP) tables for the groundwater analyses are provided in Appendix A of this document. Field guide forms outlining sample collection location, sample numbers, and analyses requested will be provided for each sample location. The forms are generated from the Integrated Environmental Data Management System database, which will ensure consistency with the SAP tables.

5.1 Quality Assurance/Quality Control Samples

The quality assurance/quality control samples (Table 5-1) will be included to satisfy the quality assurance requirements for the field operation, as described in Section 2 of the QAPjP (DOE-ID 2002).

5.2 Sampling Locations

The wells selected for the OU 2-13 post-ROD monitoring and the rationale for inclusion in the monitoring network are described in Section 3. Table 5-2 provides the necessary well construction information (date drilled, total depth, screen interval, casing diameter, etc.) and purge volume requirements for the wells to be monitored.

5.3 Sampling Frequency

Based on the past 3 years of groundwater monitoring, a semiannual monitoring frequency for both the deep-purged water system and SRPA wells will be implemented. The well, analytes, and sample frequency are identified in Table 3-4.

Table 5-1. The quality assurance/quality control samples for groundwater analyses.

Activity	Type	Comment
Groundwater Analyses	Duplicate	Field duplicates will be collected at a frequency of one per 20 samples.
	Field blank	Field blanks will be collected at a frequency of one per 20 samples.
	Rinsate	Equipment rinsate samples will be collected if the well does not have a dedicated pump. A minimum of one rinsate sample will be collected per sampling event.
	Performance evaluation	One performance evaluation sample will be submitted for each round of sampling in which radionuclide samples, other than tritium, are collected in accordance with PRD-5030, "Environmental Requirements for Facilities, Processes, Materials, and Equipment," and MCP-3480, "Environmental Instructions for Facilities, Processes, Materials, and Equipment."

MCP = management control procedure
PRD = program requirements document

Table 5-2. Well construction specifications.

Well	Date Installed	Total Depth (ft)	Well Screen/ Open Hole	Screened Interval(s) (ft bls)	Pump	Casing Diameter (in.)	Depth to Water[a] (ft bls)	Estimated Purge Volume[b] (gal)
PW-11	1990	134.5	Stainless-steel well screen	109 to 129	Submersible	4[c]	104.4	59 to 98
PW-12	1990	133	Stainless-steel well screen	108 to 128	Submersible	4[c]	82.0	100 to 166
PW-14	1990	126	Stainless-steel well screen	93 to 123	Submersible	4[c]	98.2	49 to 82
USGS-53	1960	90	Perforated steel casing	50 to 67 75 to 80	Submersible	4[c]	72.7	76 to 127
USGS-54	1960	91	Open hole	60 to 91	Submersible	6	75.0	71 to 118
USGS-55	1960	81	Open hole	45 to 80	Submersible	6	72.5	37 to 62
USGS-56	1960	80	Open hole	59 to 80	Submersible	6	71.5	37 to 62
Hwy-3	1967	750	Open hole	680 to 750	Submersible	8	538.8	1,644
TRA-06	1990	562	Stainless-steel well screen	528 to 558	Submersible	4[c]	470.1	180 to 300
TRA-07	1990	501	Stainless-steel well screen	463 to 493	Submersible	4[c]	474.3	52 to 87
TRA-08	1990	501.5	Stainless-steel well screen	471.5 to 501.5	Submersible	4[c]	478.9	44 to 74
USGS-58	1961	503	Open hole	218 to 03	Submersible	6	464.1	171 to 285
USGS-65	1960	498	Open hole	456 to 498	Submersible	6	468.9	128 to 214

a. Water-level measurement is from the Third Annual Technical Memorandum (Arnett, Meachum, and Jessmore 1996).

b. Purge volumes indicated on table include calculations for both three and five well-bore volumes.

c. Inside diameter

bls = below land surface
TRA = Test Reactor Area
USGS = United States Geological Survey

6. SAMPLING DESIGNATION

6.1 Sample Identification Code

A systematic character identification (ID) code will be used to uniquely identify all samples. Uniqueness is required for maintaining consistency and preventing the same ID code from being assigned to more than one sample.

The first three designators of the code (**GWM**) refer to the sample originating from groundwater-monitoring activities. The next three numbers designate the sequential sample number for the project. The seventh and eighth characters represent a two-character set (i.e., 01, 02) for designation of field duplicate samples. The last two characters refer to a particular analysis and bottle type. Refer to the SAP tables in Appendix A for specific bottle code designations.

For example, a groundwater sample collected in support of the post-ROD monitoring might be designated as GWM00101R4, where (from left to right):

- GWM designates the sample as being collected for post-ROD groundwater monitoring
- 001 designates the sequential sample number
- 01 designates the type of sample (01 = original, 02 = field duplicate)
- R4 designates gamma spectrometric analysis.

A SAP table/database will be used to record all pertinent information (well designation, media, date, etc.) associated with each sample ID code. The SAP tables for the Waste Area Group (WAG) 2 post-ROD monitoring are presented in Appendix A.

6.2 Sampling and Analysis Plan Table/Database

6.2.1 General

A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following sections describe the information recorded in the SAP table/database (Appendix A).

6.2.2 Sample Description Fields

The sample description fields contain information relating individual sample characteristics.

6.2.2.1 Sampling Activity. The sampling activity field contains the first six characters of the assigned sample number. The sample number will be used in its entirety to link information from other sources (field data, analytical data, etc.) to information in the SAP table for data reporting, sample tracking, and completeness reporting. The sample number also will be used by the analytical laboratory to track and report analytical results.

6.2.2.2 Sample Type. Data in this field will be selected from the following:

REG for a regular sample

QC for a quality control (QC) sample.

6.2.2.3 Media. Data in this field will be selected from the following:

GROUNDWATER

WATER for other water samples (e.g., rinsates, field blanks, trip blanks).

6.2.2.4 Collection Type. Data in this field will be selected from the following:

GRAB for grab

COMP for composite

TBLK for trip blanks

FBLK for field blanks

RNST for rinsates

DUP for duplicate samples.

6.2.2.5 Planned Date. This date, or event identifier, is related to the planned sample collection start date.

6.2.3 Sample Location Fields

This group of fields pinpoints the exact location for the sample in three-dimensional space, starting with the general AREA, narrowing the focus to an exact location geographically, then specifying the DEPTH in the depth field. The DEPTH identified in the depth field will correspond to the completion interval of the well.

6.2.3.1 Area. The AREA field identifies the general sample-collection area. This field should contain the standard identifier for the INEEL area being sampled. For this investigation, samples are being collected from the Test Reactor Area; thus, the area identifier will be "TRA."

6.2.3.2 Location. This field may contain geographical coordinates, x-y coordinates, building numbers, or other location-identifying details, as well as program-specific information (such as a borehole or well number). Data in this field normally will be subordinated to the AREA. This information is included on the labels generated by the Sampling and Analysis Management Department to aid sampling personnel.

6.2.3.3 Type of Location. The type of location field supplies descriptive information concerning the exact sample location. Information in this field may overlap that in the location field, but it is intended to add detail to the location. An example would be "aquifer well."

6.2.3.4 Depth. This DEPTH of a sample location is the distance in feet from surface level or a range in feet from the surface.

6.2.4 Analysis Types

6.2.4.1 AT1–AT20. These fields indicate analysis types (radiological, chemical, hydrological, etc.). Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation also should be provided, if possible.

7. SAMPLING PROCEDURES AND EQUIPMENT

This section describes the sampling procedures and equipment to be used for the planned groundwater monitoring. A presampling meeting will be held before commencement of any sampling activities to review the requirements of the GMP and HASP and to ensure that all supporting documentation has been completed.

7.1 Groundwater Monitoring

7.1.1 Groundwater Elevations

Groundwater elevations will be measured using either an electronic measuring tape (Solinst brand or equivalent) or a steel tape measure, as described in GDE-128, "Measuring Groundwater Levels." Measurement of all groundwater levels will be recorded to an accuracy 0.01 ft.

7.1.2 Well Purging

All wells, except Hwy-3, will be purged before sample collection. During the purging operation, a Hydrolab (or equivalent) will be used to measure specific conductance, pH, and temperature. Well-purging procedures are provided in GDE-127, "Sampling Groundwater." A sample for water quality analysis can be collected after a minimum of three well-casing volumes of water has been purged from the well and when three consecutive water-quality parameters are within the following limits:

- pH: ± 0.1
- Temperature ± 0.5°C
- Specific conductance ± 10 μmhos/cm.

7.1.3 Groundwater Sampling

Before sampling, all nondedicated sampling equipment that is exposed to the water sample will be cleaned following the procedure outlined in Technical Procedure (TPR) –6575, "Decontaminating Sampling Equipment in the Field." Following sampling, all nondedicated equipment that was exposed to the well water will be decontaminated in accordance with TPR-6575 before storage. An exception to TPR-6575 is that the isopropanol steps for decontamination will be omitted.

The water level in each well will be measured before purging. Then, the well will be purged a minimum of three well-casing volumes until the pH, temperature, and specific conductance of the purge water have stabilized or until a maximum of five well-casing volumes have been removed. If the well goes dry before purging 3 well bore volumes, purging will be considered complete and samples collected thereafter. If parameters are still not stable after five volumes have been removed, samples will be collected and appropriate notations will be recorded in the logbook.

Groundwater samples will be collected for the analyses defined in Section 3. The requirements for containers, preservation methods, sample volumes, and holding times are provided in Table 7-1.

Table 7-1. Specific sample requirements—groundwater samples.

Analytical Parameter	Container Size[a]	Container Type	Preservative	Holding Time
Target Analyte List[b] metals (filtered and unfiltered)	1 L	HDPE[c]	pH <2 with HNO_3	6 months
Fluoride	500 mL	Glass or HDPE	Cool to 4°C	28 days
Mercury (filtered and unfiltered)	250 mL	HDPE[c]	pH <2 with HNO_3	28 days
Tritium	125 mL	Glass	None	6 months
Sr-90 or Am-241	1 L 1 L	HDPE[c] HDPE[c]	pH <2 with HNO_3 pH <2 with HNO_3	6 months 6 months
Gamma-emitting radionuclides	1 L	HDPE[c]	pH <2 with HNO_3	6 months

a. Size may change depending on laboratory. Refer to field guidance forms before sampling.
b. Target Analyte List Metals—any combination of the following: Cd, Cr, As, Be, Co, Pb, Mn.
c. HDPE = high-density polyethylene.

Sample bottles for groundwater samples will be filled to approximately 90 to 95% of capacity to allow for content expansion or preservation. Samples to be analyzed for metals will be both unfiltered and filtered through a 0.45-μm filter. Samples requiring acidification will be acidified to a pH <2 using ultra pure nitric acid. The preferred order for sample collection is:

- Temperature, pH, specific conductance, and dissolved oxygen (during purging)
- Metals—Cd, Cr, and Hg (filtered and unfiltered)
- Radionuclides (unfiltered)
- Fluoride (unfiltered).

7.1.4 Personal Protective Equipment

The PPE required for this sampling effort is discussed in Section 9 of the project HASP. All PPE will be characterized before disposal based on groundwater and field screening results. In addition, a hazardous waste determination shall be made in accordance with the requirements set forth in MCP-62, "Waste Generator Services—Low-Level Waste Management."

7.2 Handling and Disposition of Remediation-Derived Waste

Remediation-derived Comprehensive Environmental Response, Compensation, and Liability Act waste will be generated at OU 2-13 as a result of the groundwater-monitoring activities described herein. The disposition and handling of waste for this project will be consistent with the *Waste Certification Plan for the Environmental Restoration Program* (Jones 1997). Samples will be handled in accordance with PRD-5030 and MCP-3480 and disposed of by the subcontracted laboratory following analysis. All waste streams generated from the sampling activity will be characterized in accordance with MCP-62 and will be handled, stored, and disposed of accordingly. All remediation-derived waste will be managed and handled as non-Resource Conservation and Recovery Act waste pending Idaho Department of Environmental Quality approval that the Radioactive Liquid Waste System is not listed. Remediation-derived waste will be stored in a designated, controlled area inside the TRA facility. Solid waste will include material such as PPE, purged water, paper, packaging, and towels generated during sample preparation and packaging. Assuming Idaho Department of Environmental Quality approval occurs, the waste will be dispositioned accordingly as radioactive only waste.

Liquid waste from groundwater sampling will consist of purge water from the deep-purged water system and SRPA that has been pumped from the wells. Purge water will be generated before sample collection in accordance with GDE-127 to remove standing water from the well casing. This standard operating procedure requires three to five well volumes be removed from the well and other water quality parameters must be met before samples are collected. The estimated amount of purge water generated from each well is provided in Table 5-2.

Purge water from all wells, except Hwy-3, TRA-06 and USGS-58, will be disposed of as directed by TRA Waste Generator Services. Purge water from TRA-06 and USGS-58 will be discharged to the ground near the well heads. Purging of the Hwy-3 well is not required, as the pump runs continuously.

8. DOCUMENTATION MANAGEMENT AND SAMPLE CONTROL

Section 8.1 summarizes document management and sample control. Documentation includes field logbooks used to record field data and sampling procedures, chain-of-custody forms, and sample container labels. Section 8.2 outlines the sample handling and discusses chain-of-custody, radioactivity screening, and sample packaging for shipment to the analytical laboratories. The analytical results from these sampling efforts will be documented in a series of technical memoranda that are prepared on an annual basis.

8.1 Documentation

The FTL will be responsible for controlling and maintaining all field documents and records and for ensuring that all required documents will be submitted to the ER Administrative Records and Document Control Center. All entries will be made in permanent ink. All errors will be corrected by drawing a single line through the error and entering the correct information; all corrections will be initialed and dated.

8.1.1 Sample Container Labels

Waterproof, gummed labels generated from the SAP database will display information such as the sample ID number, the name of the project, sample location, and analysis type. In the field, labels will be completed and placed on the containers before collecting the sample. Information concerning sample date, time, preservative used, field measurements of hazards, and the sampler's initials will be filled out during field sampling.

8.1.2 Field Guidance Forms

Field guidance forms, which are provided for each sample location, will be generated from the SAP database to ensure unique sample numbers.

These forms are used to facilitate sample container documentation and organization of field activities and contain information regarding the following:

- Media
- Sample ID numbers
- Sample location
- Aliquot ID
- Analysis type
- Container size and type
- Sample preservation.

8.1.3 Field Logbooks

In accordance with Administrative Records and Document Control format, field logbooks will be used to record information necessary to interpret the analytical data. All field logbooks will be controlled and managed according to TPR-4910, "Logbook Practices for ER and Deactivation, Decontamination, and Decommissioning Projects."

8.1.3.1 Sample/Shipping Logbook. The field teams will use sample logbooks. Each sample logbook will contain information such as:

- Physical measurements (if applicable)
- All QC samples
- Shipping information (e.g., collection dates, shipping dates, cooler ID number, destination, chain-of-custody number, name of shipper)
- All team activities
- Problems encountered
- Visitor log
- List of site contracts.

This logbook will be signed and dated at the end of each day's sampling activities.

8.1.3.2 Field Instrument Calibration/Standardization Logbook. A logbook containing records of calibration data will be maintained for each piece of equipment requiring periodic calibration or standardization. This logbook will contain log sheets to record the date, time, method of calibration, and instrument ID number.

8.2 Sample Handling

All samples will be handled in accordance with MCP-9364, "Handling, Storing, and Shipping Samples." Qualified (Sampling and Analysis Management-approved) analytical and testing laboratories will be used to analyze the groundwater samples.

8.2.1 Sample Containers

Analytical samples for laboratory analyses will be collected in precleaned bottles and packaged in accordance with Section 3.6, "Sample Containers," in the QAPjP (DOE-ID 2002).

8.2.2 Sample Preservation

Preservation of water samples will be performed before sample collection. The temperature will be checked periodically before shipment to certify adequate preservation for those samples requiring temperatures at 4°C (39°F) for preservation. Ice chests (coolers) containing frozen reusable ice will be used to chill samples, if required, in the field after sample collection.

8.2.3 Chain-of-Custody Procedures

The chain-of-custody procedures will be followed in accordance with the requirements of PRD-5030, MCP-3480, and the QAPjP (DOE-ID 2002). Sample bottles will be stored in a secured area, which is accessible only to the field team members.

8.2.4 Transportation of Samples

Samples will be shipped in accordance with the regulations issued by the DOT (49 CFR 171 through 178) and EPA sample handling, packaging, and shipping methods (40 CFR 261.4[d]). All samples will be packaged in accordance with the requirements set forth in MCP-3480 and PRD-5030.

8.2.4.1 Custody Seals. Custody seals will be placed on all shipping containers in such a way as to ensure that sample integrity is not compromised by tampering or unauthorized opening. Clear-plastic tape will be placed over the seals to ensure that the seals are not damaged during shipment.

8.2.4.2 On-Site and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL. Site-specific requirements for transporting samples within Site boundaries and those required by the Shipping/Receiving Department will be followed. Shipment within the INEEL boundaries will conform to DOT requirements, as stated in 49 CFR, "Transportation." Off-Site sample shipment will be coordinated with Packaging and Transportation Department personnel, as necessary, and will conform to all applicable DOT requirements.

8.3 Document Revision Requests

Revisions to this document will follow MCP-233, "Process for Developing, Releasing, and Distributing ER Documents (Supplemental to MCP-135 & MCP-9395)."

9. REFERENCES

40 CFR 261.4(d), 2003, "Samples," *Code of Federal Regulations*, Office of the Federal Register, February 2003.

40 CFR 300, 2003, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, Office of the Federal Register, January 2003.

49 CFR, 2002, "Transportation," *Code of Federal Regulations*, Office of the Federal Register, December 2002.

49 CFR 171, 2003, "General Information, Regulations, and Definitions," *Code of Federal Regulations*, Office of the Federal Register, February 2003.

49 CFR 172, 2003, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements," *Code of Federal Regulations*, Office of the Federal Register, February 2003.

49 CFR 173, 2003, "Shippers—General Requirements for Shipments and Packagings," *Code of Federal Regulations*, Office of the Federal Register, February 2003.

49 CFR 175, 2002, "Carriage by Aircraft," *Code of Federal Regulations*, Office of the Federal Register, November 2002.

49 CFR 176, 2002, "Carriage by Vessel," *Code of Federal Regulations*, Office of the Federal Register, November 2002.

49 CFR 178, 2003, "Specifications for Packagings," *Code of Federal Regulations*, Office of the Federal Register, February 2003.

Anderson, S. R., 1991, *Stratigraphy of the Unsaturated Zone and Uppermost Part of the Snake River Plain Aquifer at the Idaho Chemical Processing Plant and Test Reactor Area, Idaho National Engineering Laboratory, Idaho*, Water Resources Investigation Report 91-4010, U.S. Geological Survey, p. 71, January 1991.

Arnett, R. C., T. R. Meachum, and P. J. Jessmore, 1996, *Post-Record of Decision Monitoring for the Test Reactor Area Perched Water System Operable Unit 2-12, Third Annual Technical Memorandum*, INEL-96/0305, Revision 0, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, August 1996.

Bartholomay, R. C., B. J. Tucker, D. J. Ackerman, and M. J. Liszewski, 1997, *Hydrogeologic Conditions and Distribution of Selected Radiochemical and Chemical Constituents in Water, Snake River Plain Aquifer, Idaho National Engineering Laboratory, Idaho, 1992–1995*, Water Resources Investigation Report 97-4086, U.S. Geological Survey, April 1997.

Cecil, L. D., B. R. Orr, T. Norton, and S. R. Anderson, 1991, *Formation of Perched Ground-Water Zones and Concentrations of Selected Chemical Constituents in Water, Idaho National Engineering Laboratory, Idaho, 1986–88*, Water Resources Investigation Report 91-4166, U.S. Geological Survey, p. 53, January 1991.

Dames and Moore, 1992, *Remedial Investigation Report for the Test Reactor Area Perched Water System (Operable Unit 2-12),* EGG-WM-10002, Revision 0, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, June 1992.

Dames and Moore, 1993, *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12*, EGG-ER-10547, Revision 1, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, August 1993.

DOE-ID, 1991, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory,* Administrative Record No. 1088-06-29-120, U.S. Department of Energy Operations Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, December 4, 1991.

DOE-ID, 1992, *Record of Decision for the Test Reactor Area Perched Water System, Operable Unit 2-12*, Doc. ID 5230, Revision 0, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, December 1992.

DOE-ID, 1997a, *Final Record of Decision for Test Reactor Area, Operable Unit 2-13*, DOE/ID-10586, Revision 0, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, December 1997.

DOE-ID, 1997b, *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10531, Revision 0, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, February 1997.

DOE-ID, 1997c, *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL—Part A, RI/BRA Report (Final),* DOE/ID-10534, Revision 0, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, November 1997.

DOE-ID, 2002, *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites*, DOE/ID-10587, Revision 7, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho, September 2002.

ER-SOW-156, 1996, "Idaho National Engineering Laboratory Statement of Work for Inorganic and Miscellaneous Classical Analyses," Revision 1, Idaho National Engineering and Environmental Laboratory, April 1996.

ER-SOW-163, 1995, "Idaho National Engineering Laboratory Sample Management Office Statement of Work for Radionuclide Analysis," Revision 0, Idaho National Engineering and Environmental Laboratory, February 1995.

GDE-127, 2003, "Sampling Groundwater," Revision 0, *Environmental Monitoring/Compliance Monitoring Handbook*, February 2003.

GDE-128, 2003, "Measuring Groundwater Levels," Revision 0, *Environmental Monitoring/Compliance Monitoring Handbook*, February 2003.

GDE-7003, 2002, "Levels of Analytical Method Data Validation," Revision 1, Environmental Restoration, December 2002.

Jones, R. K., 1997, *Waste Certification Plan for the Environmental Restoration Program*, INEL-96/0043, Revision 1, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, October 1997.

MCP-62, 2003, "Waste Generator Services—Low-Level Waste Management," Revision 5, *Manual 17–Waste Management*, January 2003.

MCP-233, 2002, "Process for Developing, Releasing, and Distributing ER Documents (Supplemental to MCP-135 & MCP-9395)," Revision 4, *Environmental Restoration Work Processes Manual*, June 2002.

MCP-3480, 2002, "Environmental Instructions for Facilities, Processes, Materials, and Equipment," Revision 8, *Manual 8–Environmental Protection and Compliance*, November 2002.

MCP-3562, 2003, "Hazard Identification, Analysis, and Control of Operational Activities," Revision 6, *Manual 9–Operations*, January 2003.

MCP-9364, 2001, "Handling, Storing, and Shipping Samples," Revision 2, *Waste Generator Services Program Handbook*, May 2001.

Morris, D. A., J. T. Barraeluugh, G. H. Chase, W. E. Teasdale, and R. G. Jensen, 1965, *Hydrology of Subsurface Waste Disposal, National Reactor Testing Station, Idaho*, ID-22-47, U.S. Geological Survey, Annual Progress Report.

Orr, B. R., L. D. Cecil, and L. L. Knobel, 1991, *Background Concentration of Selected Radionuclides, Organic Compounds, and Chemical Constituents in Ground Water in the Vicinity of the Idaho National Engineering Laboratory*, DOE/ID-22094, U.S. Geological Survey Water Resources Investigation Report 91-4015, prepared in cooperation with the U.S. Department of Energy, Revision 0, February 1991.

PRD-25, 1999, "Activity Level Hazard Identification, Analysis, and Control," Revision 2, *Manual 14A–Safety and Health–Occupational Safety and Fire Protection*, June 1999.

PRD-5030, 2002, "Environmental Requirements for Facilities, Processes, Materials, and Equipment," Revision 2, *Manual 8–Environmental Protection and Compliance*, April 2002.

Radiation Protection Department, 2000, *Manual 15A–INEEL Radiological Control Manual*, Revision 6, July 2000.

RUST Geotech, Inc., 1994, *Remedial Design and Remedial Action Guidance for the Idaho National Engineering Laboratory*, DOE/ID/12584-152, GJPO-ESO-12, Revision 2, September 1994.

Safety and Fire Protection Department, 2003, *Manual 14A–Safety and Health–Occupational Safety and Fire Protection*, TOC-48, Revision 113, February 2003.

Safety and Fire Protection Department, 2003, *Manual 14B–Safety and Health–Occupational Medical and Industrial Hygiene*, TOC-49, Revision 65, January 2003.

TPR-4910, 2002, "Logbook Practices for ER and Deactivation, Decontamination, and Decommissioning Projects," Revision 0, Environmental Restoration, May 2002.

TPR-6575, 2001, "Decontaminating Sampling Equipment in the Field," Revision 0, *Environmental Monitoring/Compliance Monitoring Handbook*, May 2001.

Appendix A

Sampling and Analysis Plan Tables

Plan Table Number: OU2-14-MAR03

SAP Number: DOE/ID-10626, REV. 1

Sampler: Gilbert, H. K.

Date: 02/03/2003 Plan Table Revision: 0.0 Project: OU 2-14 TRA WELLS - MARCH 2003 GROUNDWATER SAMPLING Project Manager: M. J. MCGUIRE

SMO Contact: KIRCHNER, D. R.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																			
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	UC	6C	5C	CU	R4	RB	R8													
TRA028	REG	GROUND WATER	GRAB		03/03/2003	TRA	PERCHED WELL	PW-11	134.5	1	1	1	1	1	1	1													
TRA029	REG	GROUND WATER	GRAB		03/03/2003	TRA	PERCHED WELL	PW-12	133	1	1	1	1	1	1	1													
TRA030	REG	GROUND WATER	GRAB		03/03/2003	TRA	PERCHED WELL	PW-14	123	1	1	1	1	1	1	1													
TRA031	REG	GROUND WATER	GRAB		03/03/2003	TRA	PERCHED WELL	USGS-053	90	1	1	1	1	1	1	1													
TRA032	REG/QC	GROUND WATER	DUP		03/03/2003	TRA	PERCHED WELL	USGS-054	91	2	2	2	2	2	2	2													
TRA033	REG	GROUND WATER	GRAB		03/03/2003	TRA	PERCHED WELL	USGS-055	81	1	1	1	1	1	1	1													
TRA034	REG	GROUND WATER	GRAB		03/03/2003	TRA	PERCHED WELL	USGS-056	80	1	1	1	1	1	1	1													
TRA035	REG	GROUND WATER	GRAB		03/03/2003	TRA	AQUIFER WELL	TRA-06A	562	1	1	1	1			1													
TRA036	REG	GROUND WATER	GRAB		03/03/2003	TRA	AQUIFER WELL	TRA-07	501	1	1	1	1			1													
TRA037	REG	GROUND WATER	GRAB		03/03/2003	TRA	AQUIFER WELL	TRA-08	501.5	1	1	1	1			1													
TRA038	REG	GROUND WATER	GRAB		03/03/2003	TRA	AQUIFER WELL	USGS-058	503	1	1	1	1			1													
TRA039	REG	GROUND WATER	GRAB		03/03/2003	TRA	AQUIFER WELL	USGS-065	498	1	1	1	1			1													
TRA040	REG	GROUND WATER	GRAB		03/03/2003	TRA	AQUIFER WELL	HWY-3	750			1	1																
TRA041	QC	WATER	FBLK		03/03/2003	TRA	FIELD BLANK	QC	NA	1	1	1	1	1	1	1													
TRA042	QC	WATER	RNST		03/03/2003	TRA	EQUIP RINSATE	QC	NA	1	1	1	1	1	1	1													

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Cadmium
AT2: Cadmium - Filtered
AT3: Chromium
AT4: Chromium - Filtered
AT5: Gamma Spec
AT6: Sr-90
AT7: Tritium
AT8:
AT9:
AT10:

AT11:
AT12:
AT13:
AT14:
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

Comments:

Gamma Spec - analyte of concern is cobalt-60

Chromium and Cadmium (5C and UC) - unfiltered

Chromium - Filtered and Cadmium - Filtered (6C and CU) will be filtered in the field

Monitor previously dry wells PW-14, USGS-53, and USGS-56 to see if still dry; if not dry, then measure, monitor, and sample

Make appropriate observations and measurements of diesel product per DAR from DWPS Well PW-13. If product thickness is greater than 0.2 feet - contact project manager.

Analysis Suites:

Contingencies: